

THE **DEMAND** FOR ENGINEERS

1982

conducted by the
ENGINEERING MANPOWER COMMISSION
of the
AMERICAN ASSOCIATION OF
ENGINEERING SOCIETIES, INC.

THE DEMAND FOR ENGINEERS 1982

ENGINEERING MANPOWER COMMISSION

A Commission of the Engineering Affairs Council
of the
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The Engineering Manpower Commission was organized in 1950 to serve as a focus for national technological manpower issues.

The Commission's program is carried out through the collection, analysis, and publication of significant data on engineering manpower, as well as the development of programs and policies designed to acquaint the public with the importance of engineering to the national welfare.

The Engineering Manpower Commission is charged with the following responsibility:

"To engage in studies and analyses of the supply, demand, and utilization of engineering and technical manpower; to make recommendations, conduct programs and develop reports concerning these aspects of engineering and technical manpower; and to carry on such other programs in the field of manpower as may be authorized by the Engineering Affairs Council of AAES."

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The presentation of the final report was done by Carolyn Heydt and Patrick Purtell of the AAES staff under the supervision of Gary M. Hoffmann, Manager of Manpower Activities.

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INTRODUCTION

Background

Intermittently, since its formation during the Korean War, the Engineering Manpower Commission has surveyed employers of engineers to obtain information regarding the current demand for engineers. A few years ago, this survey was discontinued because of criticism that this information was being used to "predict" demand several years ahead, despite its clearly stated unreliability for this purpose. Since then, there have been numerous requests for information relating to the demand for engineers. Therefore, the Commission agreed to gather and present demand data for short-term planning purposes.

In order to ensure proper consideration of the many problems involved in setting objectives, designing the survey formats, selecting target populations, establishing timetables, and defining reporting criteria, a Demand Survey Sub-Committee of EMC was appointed.

The committee recommended in 1980 that a survey of individual engineers should be conducted with a simultaneous survey of engineering employers. That survey, "A Pilot Study of the Demand for Engineers," was executed, reporting the demand as of May 1, 1980. The resultant report, *A Pilot Study of the Demand for Engineers*, was published by EMC in April of 1981.

Because of the interest generated by this "pilot study," EMC decided to reinstate the study in 1981 and to continue it in 1982, changing the reporting date to October 31 instead of May 1. This change was made to have the demand survey coincide more closely with critical periods in employers' planning of the recruitment of engineering manpower. A few changes were made in Survey Form A, which was sent to individual society members. The changes were directed at simplifying certain portions, making the engineer sample more consistent with the employer sample, and extending the data to include an indication of the total work force, as well as engineering work force in the employing organization. Appendix A contains copies of survey instruments as mailed in 1982 for both the individual engineer and employer samples.

The populations of both the individual engineer sample and the employer sample addressed by the 1982

survey were expanded considerably from those in the "pilot" survey, and were designed to be representative of the membership of constituent Societies of AAES.

However, the committee wished to note the following:

1. The information requested of both samples limits the demand prediction to one year from the baseline conditions reported as of October 31, 1982.
2. The reported results can be considered only indicative of, and should not be interpreted as an absolute measure of, current demand trends.
3. The validity of such a survey can be estimated only by comparing predictions and results from successive surveys executed over a period of years.

Sample Selection, Mailings and Returns

Individual Engineers:

A randomly selected sample of 11,810 primarily U.S. members of 23 technical societies was addressed using the letter and survey forms shown in Appendix A. From this single mailing, 2,592 useable returns were obtained, showing a valid response of 21.9%. Of those societies surveyed, only the following, in rank order of number of useable returns, proved to have a sufficient number to be meaningful:

American Society of Mechanical Engineers	(ASME)
Institute of Electrical and Electronic Engineers	(IEEE)
American Society of Civil Engineers	(ASCE)
National Society of Professional Engineers	(NSPE)
National Institute of Ceramic Engineers	(NICE)
American Institute of Aeronautics & Astronautics	(AIAA)
American Nuclear Society	(ANS)
American Society of Metals	(ASM)
American Institute of Industrial Engineers	(AIIE)
American Society of Agricultural Engineers	(ASAE)

For reasons unknown at this time, the mailing and returns from the individual engineers in the AIChE to this survey were defective, resulting in bias in the analysis of both that profession and of the industries employing chemical engineers. Thus greater weight must be placed on the employer returns for that profession and industry.

Results are presented in Appendix B1 in abbreviated form for the composite total of all individual returns, and for each of the above listed societies. Information on others in the list of 25 participating societies is shown in Appendix C1. Although salary data are reported in composites, in Appendix B1, analyses are difficult due to variations in the populations reporting history and forecasts.

Selections of random samples from listings of individual engineers furnished by the engineering societies were developed with the intent of achieving a reasonable balance between the largest society, having approximately 133,000 members, and the smallest society, having about 500 members. In order to avoid weighting the selection in favor of the larger societies and yet yield a projected sample of approximately 12,000, it was decided to calculate the sample size from a given society by the relation $4\sqrt{n}$, in which "n" is the total society membership. Details of society response are shown in Appendix C1-B.

Employers:

A total of 2,863 employers of engineers were selected for both an initial and a follow-up mailing, assuming an anticipated return of about 30%. As of the date of this report, 333 useable returns have been received, 12% of which are government agencies, 11% are consulting

engineering firms, and the balance, approximately 77%, are business firms. In aggregate, this sample of organizations employs 140,690 engineers.

Summaries of the employers engineering work force history and forecasts by discipline and region are tabulated in Appendix B2.

Projections of Long-Term Trends Not Feasible

The data contained in this booklet should not be used for extrapolating long-term trends. Long-term trends are dependent on many factors not addressed by respondents to this survey. Among such factors are:

1. The amount and distribution of federal expenditures for energy, including synfuel and space, defense, environmental protection, and highway projects, especially their R&D components, which are engineering labor intensive.
2. Industrial expenditures on R&D and capital investment, which are impacted by tax treatment, regulation burden, cost of money, investment philosophy, and willingness to venture, compete, or export.
3. The secular trend of the economy, which determines the level of output of industries which employ engineers.
4. Scientific breakthroughs, such as microprocessors, which have a disproportionate effect on engineering requirements for development.
5. The transfer of engineers to other occupations, which creates new engineering job openings.

We welcome your comments, recommendations, and advice as to whether this is the proper approach, or whether we should continue this research.

SUMMARY

1982 SURVEY OF ENGINEERING DEMAND

The Engineering Manpower Commission, organized under the Engineering Affairs Council of the American Association of Engineering Societies, has completed a survey designed to record the views of engineering employers and of individual engineers on near-term (1983) demand for engineers.

This 1982 survey is a successor to a similar 1981 survey, "The Demand for Engineers—1981," and also builds on experience from the 1980 "Pilot Study of Demand for Engineers."

This survey attempts to provide the following unique contributions to the study of short-term demand:

- a comparison of insights on demand from individual engineers and employers;
- a comparison of the proportion of engineers reporting that they are seeking employment with employers' plans for hiring experienced engineers (this includes a profile of engineers seeking jobs); and,
- identification of some factors associated with individual engineers' optimism (or pessimism) concerning demand—e.g., professional discipline, age, geographic location, and industry.

Definition of the term "demand" and the difficulty of precisely describing "engineer" were problems that confronted the survey committee. A survey questionnaire was designed to minimize the ambiguity of these and other terms. Suggestions made by the respondents should improve the questionnaire for future surveys. There remains sufficient ambiguity, however, so that data were summarized, sorted, and reported as they were received; only limited conclusions are presented.

The EMC demand study contains summaries of demand by five engineering categories and ten geographic regions. Practicing engineers reported their views on growth in their profession, region, and industry. Employers reported history and demand by five engineering categories, as well as by region. Comparisons of views of engineering demand by category have been made; however, some definitional problems should be recognized. For example, engineers reported by professional society affiliation, while employers reported on the basis of engineering job assignment.

Although employer and employee survey samples were similar in many respects, several differences in the composition of the two samples were significant:

1. **Employer Size**—There is a greater representation of engineers working for small employers in the employee sample than in the employer sample.
2. **Society or Discipline**—There is a greater overall representation of engineers from smaller societies in the sample of individuals and a greater representation of electrical engineers in the employer sample. As noted in the introduction, the sample of individual chemical engineers was defective.
3. **Industry and Education Level**—There is a greater representation of consultants, educational institutions, and the ceramic industry among individual returns, and a greater representation of construction, communications services, and the chemical-drug industry among employer returns. In addition, a greater representation of Ph.D.s is included in the individual sample.

Overall Findings

Both employers and individual engineers reported a very weak 1982. Individuals reported significantly higher (though still relatively low) unemployment, while employers reported a net decrease in the number of experienced engineers employed. Employers, however, had continued college hiring at a 5.5% rate in 1982, about as forecast in the 1981 survey. For 1983, employers forecast an overall 4.7% growth in the engineering work force, similar to the 4.2% in 1982, but comprised of a lower rate of college hiring (4.2% vs. 5.5%), maintenance of experienced hiring (4.6% vs. 4.7%), and a sharp drop in separations (4.1% vs. 6.0%). About half the individual engineers forecast steady employment in 1983. Those individuals expecting a rise in demand (1) exceeded the number of those expecting a decline for the profession, (2) were equal to those expecting a decline for their employer organization; and (3) were fewer than those expecting a decline regionally.

Employers expect to hire experienced engineers equivalent to 4.6% of their work force in 1983, but 14% of

experienced engineers surveyed report that they are seeking new employment.

Categorical Findings

At least a plurality of engineers in almost every professional society forecasts steady demand (Table 2B).

Data indicates industrial engineers remain slightly more optimistic than their employers (Table 4A-1).

Individual engineers in the South Atlantic region are relatively the most optimistic regionally, although a plurality there still foresees steady employment. Employers in the Pacific region are most optimistic while in that region individuals are also relatively optimistic, although, as in most regions, more individuals foresee a regional decline in 1983 than a rise (Table 4B-1).

Engineers seeking new employment at above-average rates include consultants and those in engineering services and fabricated metal products (Table 8B).

Employers forecast highest demand growth for electrical engineers (5.4%), especially in the Pacific, New England, and West North Central regions. Weakest demand growth is for civil engineers (1.7%), especially in the Mid-Atlantic regions where employment is forecast to continue to decline (Table 3B).

Analyses of Returns

Information Requested:

Questionnaires sent to both individual engineers and employers were designed to provide two types of information:

- an assessment of the present and future engineering demand, and

- a profile of engineers represented in the survey.

Thus, the individual engineers' questionnaire requested profile data such as highest degree attained, employment group, geographic location, and size of employer's engineering work force. In addition, demand data such as current employment status, expectations of future employment, past, present, and future salary level, and opinions of trends in engineering employment were requested.

Both groups provided demand-related information as of October 31, 1982.

Data Reduction:

In order to handle the processing of the large amount of data contained in the returns, a computer program using the Pascal language was developed for use on the Univac-1100 computer at SUNY-Stony Brook.

Format of the Final Report

Current and forecast demand status are summarized for each of the two survey groups.

The individual engineer summary includes comparisons of actual and forecast employment status and demand by years since graduation, size of work force, society affiliation, geographic region, and employment group. The employer summary includes reported results for 1982 and expected results for 1983.

Comparisons of individual engineer and employer expectations are tabulated.

Information in the appendices includes:

- medians for individual societies;
- summaries of employer data; and
- comparisons with 1981 and 1980 surveys.

DIGEST OF COMPOSITE RESULTS

This section summarizes trends in demand from both individual engineer (i.e., professional society member) and employer viewpoints, compares the composition of the samples from which the individual engineer and employer composites were drawn, and comments briefly on the samples and trends.

More detailed summaries of the processed data may be found in Appendix B.

A. Trends in Demand

Individual Engineer Viewpoint:

Generally, engineers expect a slight decrease both in employment and in unemployment, somewhat balanced by more retirements as illustrated in Table 1A. However, differences are obscured by the "no answer" response to requests for forecasting 1983 status.

The last column of Table 1A shows a comparison of the distribution of the status expected by 2,592 in-

dividual engineers in 1983 and their status in 1982. That last column shows only a small decrease (0.9 points) in the proportion of engineers employed in engineering or engineering-related work and among the unemployed engineers (1.2 points). This 2.1 point decrease is compensated for by changes in the proportion not answering (0.6 points), retired (0.8 points), or by increases in employment in part-time (0.4 points) and non-engineers work (0.2 points).

Table 1B details the "Points Change 83-82" column for tables similar to Table 1A. The first column repeats data from Table 1A. The second column reports the points change 83-82 for the subset of 719 individual engineers who forecast rises in demand in their profession. The third column similarly reports for the subset of 543 individuals who forecast declines in their profession; the succeeding columns report on subsets concerning regional forecasts and engineers seeking new engineering employment.

TABLE 1A
INDIVIDUAL ENGINEER EMPLOYMENT STATUS

	1981 Status % Replies	1982 Status % Replies	Points Change 82-81	1983 Expected Status % Replies	Points Change 83-82
Employed as Engineer	74.2	71.9	(2.3)	71.5	(0.4)
Employed Engr.—Related Work	12.5	12.1	(0.4)	11.6	(0.5)
Sub-Total	86.7	84.0	(2.7)	83.1	(0.9)
Employed Non-Engineer Work	4.8	5.1	0.3	5.3	0.2
Part-time Engr. Work	1.0	1.4	0.4	1.5	0.1
Part-time Engr.—Related Work	0.9	0.8	(0.1)	1.0	0.2
Part-time Non-Engr. Work	0.3	0.4	0.1	0.4	0.0
Sub-Total	2.2	2.6	0.4	3.0	0.4
Unemployed, Not Retired	0.7	1.8	1.1	0.6	(1.2)
Retired	3.7	4.8	1.1	5.5	0.8
Other	1.0	0.7	(0.3)	0.7	0.0
No Answer	0.9	1.2	0.3	1.8	0.6
Total Rounded	100.0	100.0	0.0	100.0	0.0

() denotes negative value

Among "optimists," i.e., the subset of 719 individuals forecasting rises in demand, increases in both full and part-time employment, and "no answer" balance the decreases in unemployed, and in those employed in non-engineering work.

In the subset of 322 individuals who are seeking employment, there is an expectation of increases in employment in all categories and an increase in the number retired. These expected increases are more than offset by the indication of anticipated decreases in unemployment.

A comparison of employment status by years since bachelor's degree is shown in Table 1C. The proportion

of engineers who are retired increases with age, as might be expected. The sharpest 1982 to 1983 increase in proportion retired occurs in the 30-40 years-since-bachelors group, with the proportion rising from 6.8% to 9.4%. There is also a notable trend towards part-time employment as age increases.

When the employment status of the individual engineer is analyzed by the size of the engineering work force, as shown in Table 1D, it indicates that 1982 unemployment for individuals in large work forces was appreciably lower. However, 1983 expectations are comparable.

TABLE 1B
CONTRASTS IN EMPLOYMENT STATUS REPORTS
(Points of Percentage Change 83/82)

	Overall	Profession		Local Area		Seeking	Not Seeking
		Forecast Rise	Forecast Decline	Forecast Rise	Forecast Decline		
Employed Engineer Work Sub-Total	(0.9)	(0.4)	(1.5)	(0.6)	(0.5)	(4.7)	(1.4)
Employed Non-Engineer Work	0.2	(0.4)	0.6	0.0	0.4	0.6	(0.1)
Part-Time Employed Sub-Total	0.4	(0.6)	0.8	0.4	0.7	0.9	0.3
Unemployed, Not Retired	(1.2)	(1.1)	(2.5)	(0.4)	(2.5)	(8.1)	(0.2)
Retired	0.8	0.1	1.7	0.4	1.1	0.3	0.8
Other	0.0	(0.1)	(0.2)	0.0	(0.1)	(0.6)	0.1
No Answer	0.6	0.6	1.1	0.2	1.0	2.2	0.3
Total Rounded	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Number of Replies	2592	719	530	543	833	322	2127

() denotes negative value

TABLE 1C
EMPLOYMENT STATUS BY YEARS SINCE BACHELOR'S DEGREE

	Overall		0-10		11-20		21-30		31-40		41-50	
	82 %	83 %	82 %	83 %	82 %	83 %	82 %	83 %	82 %	83 %	82 %	83 %
Employed Engineer Work Sub-Total	84.0	83.1	90.4	90.3	88.6	89.0	88.5	88.3	79.2	76.1	37.5	32.0
Employed Non- Engineer Work	5.1	5.3	3.7	3.9	6.3	6.6	6.0	6.4	5.0	5.0	0.8	0.8
Part-time Employed Sub-Total	2.6	2.9	1.2	1.8	1.0	1.0	1.6	1.8	5.1	5.7	12.5	14.1
Unemployed, Not Retired	1.8	0.6	1.8	0.5	2.1	0.7	1.4	0.7	2.0	0.9	1.6	0.0
Retired	4.8	5.6	0.0	0.3	0.4	0.7	1.4	1.6	6.8	9.4	44.5	46.9
Other	0.7	0.7	1.5	1.2	0.2	0.2	0.4	0.2	0.4	0.7	1.6	3.1
No Answer	1.2	1.8	1.2	2.0	1.4	1.8	0.7	1.1	1.5	2.2	1.6	3.1
Total Rounded	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number of Replies	2592		648		572		565		456		128	

TABLE 1D
EMPLOYMENT STATUS BY SIZE OF ENGINEERING WORK FORCE

	Overall			Small Self-employed or fewer than 100 Engineers			Large Employer with more than 100 Engineers		
	% 82	% 83	Points Change	% 82	% 83	Points Change	% 82	% 83	Points Change
Employed Engineer Work Sub-Total	84.0	83.1	(0.9)	83.9	82.8	(1.1)	89.4	88.6	(0.8)
Employed Non- Engineer Work	5.1	5.2	0.1	5.8	6.1	0.3	4.2	4.3	0.1
Part-time Employed Sub-Total	2.6	2.9	0.3	3.6	4.0	0.4	0.9	1.1	0.2
Unemployed, Not Retired	1.8	0.6	(1.2)	1.9	0.5	(1.4)	0.8	0.5	(0.3)
Retired	4.8	5.6	0.8	3.1	4.0	0.9	2.7	3.5	0.8
Other	0.7	0.7	0.0	0.6	0.8	0.2	0.6	0.5	(0.1)
No Answer	1.2	1.8	0.6	1.0	1.8	0.8	1.4	1.5	0.1
Total Rounded	100.0	100.0	0.0	100.0	100.0	0.0	100.0	100.0	0.0
Number of Replies	2592			1438			1060		

() denotes negative value

Considerable turnover is expected (about 14% of engineers are seeking employment). The statistics of those seeking employment are explored in greater detail under "Make-up of Sample" below, since these data relate to supply, rather than demand.

During 1982 the proportion of engineers reporting unemployment, although small, increased significantly relative to 1981. Lower unemployment rates are

expected for 1983. Table 1E presents a breakdown of unemployment reports by society, region and industry. Especially high rates are reported by manufacturing engineers and by the non-electrical machinery manufacturing industry, although samples were small. Among larger groups, ASAE, the West South Central region and consultants reported significantly above-average unemployment.

TABLE 1E
UNEMPLOYMENT RANGES
(UNEMPLOYED, NOT RETIRED)
BY PROFESSIONAL SOCIETY, REGION, AND EMPLOYER GROUP
(% of Replies)

	Count	1981 Status	1982 Status	1983 Expected Status
Overall	2592	0.7	1.8	0.6
Societies at High End				
SME	86	1.2	5.8	2.3
SAE	41	0.0	2.4	0.0
ASAE	124	0.0	2.4	0.8
Societies at Low End				
AIAA	160	0.0	0.6	0.6
ANS	142	0.0	0.7	0.0
IEEE	378	0.5	0.8	0.3
Region at High End				
West South Central	181	0.0	2.8	1.1
Region at Low End				
New England	183	0.0	1.1	0.0
Company Size				
Less than 100 Engineers	1438	0.6	2.0	0.5
More than 100 Engineers	1060	0.2	0.8	0.5
Employer Groups at High End				
Non-electrical machinery	70	0.0	7.1	1.4
Engineering services	78	0.0	3.9	0.0
Consultants	354	0.0	3.1	0.3
Employer at Low End				
Electric utilities	126	0.0	0.0	0.8
Education	185	1.1	1.1	1.1

This year's survey showed a marked shift in outlook by the individual engineers away from optimism about employment in their professional disciplines, geographical area and their employer organization. Thus, Table 2A shows that "Remain Steady" is now the choice of the plurality where it was "Rise" in last year's survey. The choice of "Decline" increased about 9 percentage points, on the average, in all three categories, compared to last year's results.

Individuals with 0-10 years since B.S. were the most optimistic age group regarding a rise, but also had an above-average proportion forecasting decline, and a correspondingly below-average plurality forecasting "Remain Steady." Pessimism regarding local area consistently exceeded optimism, while the opposite was true regarding professional discipline.

Table 2B examines the forecasts of growth "in their profession" made by members of various professional societies. They are ranked by the "optimism" (i.e., proportion of replies from a society forecasting rise) reported in last year's survey. Except for ASEE, a plurality of replies from engineering society members forecasts steady employment. "Optimists" slightly outnumber "pessimists" (i.e., those who forecast declines) for most

societies. Among larger societies, the electrical engineers are particularly optimistic, and the civil engineers particularly pessimistic. Other "pessimistic" societies are NSPE, ASAE, AIME, and AICHe.

While the degree of optimism was markedly different, generally the ranking of societies by optimism was quite similar in 1982 except that SME and NICE are relatively more optimistic. Although AICHe and SWE are relatively more pessimistic, samples are quite small.

Table 2C examines forecasts of growth "in their company" by individual engineers in different categories of employing organization. Engineers in the electronic equipment/computer industry and the aerospace industry are predominantly "optimistic," while a plurality of engineers in the non-electric machinery industry and construction industries are "pessimistic." In most types of organizations, however, at least a plurality of engineers forecast steady employment.

The highest proportion of engineers seeking new employment were reported in the engineering service, auto and railroad equipment, and consulting businesses; somewhat lower rates were reported in electrical machinery and aerospace.

TABLE 2A
EMPLOYMENT TREND VIEWPOINT
INDIVIDUAL ENGINEER

	Years Since B.S.	% Rise	% Remain Steady	% Decline	% No Answers
In Professional Discipline	Overall	27.7	49.6	20.4	2.2
	0-10	33.5	45.2	20.7	0.6
	11-20	26.9	51.4	19.8	1.9
	21-30	25.5	52.7	20.0	1.6
	31-40	27.4	50.4	19.3	2.8
	41-50	26.0	48.4	21.9	9.4
In Local Area	Overall	20.9	44.1	32.1	2.8
	0-10	23.5	40.8	34.6	1.2
	11-20	18.7	43.7	35.3	2.3
	21-30	20.2	48.9	29.4	1.6
	31-40	21.1	46.9	27.9	4.2
	41-50	17.2	41.4	31.2	10.2
In Employer Organization	Overall	24.4	47.0	23.4	5.1
	0-10	27.9	44.0	25.2	2.8
	11-20	21.8	51.1	24.3	2.8
	21-30	26.4	48.3	22.5	2.8
	31-40	24.6	48.0	21.7	5.7
	41-50	14.1	43.0	17.2	25.8

TABLE 2B

EMPLOYMENT TREND VIEWPOINT BY PROFESSIONAL SOCIETY
(Current Survey Except Where Indicated)

Society	Count	Proportion Forecasting Rise (%)	Proportion Forecasting Steady (%)	Proportion Forecasting Decline (%)
		Current 1982 Survey	1981 Survey*	
AIIE	129	34.1	66.7	44.2
IEEE	378	40.5	55.2	43.1
ANS	142	33.1	54.7	41.5
AIChE	44	20.5	54.2	45.5
ASQC	96	28.1	52.5	49.0
ASEE	50	38.0	52.1	36.0
ASME	402	28.4	50.3	47.0
SWE	39	20.5	50.0	59.0
ASM	135	26.7	48.7	50.4
NICE	220	31.4	48.5	50.0
NSPE	229	21.0	46.7	55.1
SME	86	29.1	46.5	43.0
AIPE	69	18.8	45.7	62.3
ASHRAE	104	26.0	39.5	52.9
ASCE	364	15.4	36.0	52.2
ASAE	124	16.1	32.0	57.3
AIAA	160	35.0	N/A	53.7
AIME	59	23.7	N/A	49.2
SAE	41	34.1	N/A	46.3
ASTM	53	26.4	N/A	50.9
Overall	2592	27.7	48.9	49.6

*The Demand For Engineers -- 1981, Table D3-2A, Appendix

TABLE 2C

EMPLOYMENT TREND VIEWPOINT BY EMPLOYMENT GROUP

Employment Group	Count	Proportion Forecasting Rise (%)	Proportion Forecasting Steady (%)	Proportion Forecasting Decline (%)	Proportion Seeking Employment (%)
Consultants	354	25.4	41.5	26.3	16.1
Ceramics, Glass, Cement	274	17.5	52.9	23.0	14.6
Government	256	15.2	53.5	30.1	12.5
Aerospace	205	40.0	36.6	20.5	11.7
Educational Inst.	185	28.7	59.5	9.2	13.0
Electronic Equip. & Comp.	173	48.0	31.8	13.3	13.3
Electric & Gas Utilities	138	23.9	55.1	18.1	12.3
Metal Products	102	25.5	55.9	14.7	19.6
Engrg. Services	78	21.8	41.0	33.3	23.1
Construction	75	14.7	38.7	38.7	17.3
Non-Elec. Machinery	70	8.6	41.4	44.3	15.7
Electrical Machinery	70	20.0	51.4	15.7	11.4
Chemicals & Drugs	59	23.7	52.5	22.0	15.3
Auto & RR Equipment	55	14.5	49.1	32.7	20.0
Res. Org. & Labs	50	16.0	54.0	24.0	16.0
Communication Services	41	29.3	39.0	24.4	14.6
Overall	2592	24.4	47.0	23.4	14.3

Employer Viewpoint:

On the whole, employers predict higher growth in the employment of engineers. The projected 1983 growth rate of 4.7% is above the 4.2% growth rate experienced in 1982, as shown in Table 3A.

Table 3B shows the employers' estimates of changes in engineering employment broken down by the larger professions and by region. Highest growth in employment is forecast for electrical engineers at 5.4%

in 1983 (nearly the same as for 1982). Growth for them is particularly high in the Pacific, New England, and the West North Central regions with lower growth elsewhere.

Lowest growth rate is forecast for civil engineers at 1.7% in 1983 (nearly the same as for 1982).

Employment for them is forecast to continue to decline in the Mid-Atlantic region.

Additional regional summaries are given in Table 4B.

TABLE 3A

EMPLOYERS OF ENGINEERS — ESTIMATES OF CHANGE IN ENGINEERING EMPLOYMENT

Engineers Employed as of 10/31/82	Number of Employers Reporting	Openings Reported as of 10/31/82		Growth 10/31/81-10/31/82		Estimated Growth 10/31/82-10/31/83	
		Number	%	Number	%	Number	%
140,690	333	5251	3.7	5613	4.2	6641	4.7

TABLE 3B

EMPLOYERS OF ENGINEERS — ESTIMATES OF CHANGE IN ENGINEERING EMPLOYMENT BY REGION

	Engineers Employed as of	Openings Reported as of 10/31/82		Growth 10/31/81-10/31/82		Estimated Growth 10/31/82-10/31/83	
	10/31/82	Number	%	Number	%	Number	%
[CHEMICAL ENGINEERS]							
U.S. Gen./multireg.	249	2	0.8	10	4.2	3	1.2
Pacific	1,149	7	0.6	(27)	(2.3)	19	1.7
East N. Central	592	1	0.2	8	1.4	5	0.8
Mid-Atlantic	158	0	0.0	4	2.6	(2)	(1.3)
West S. Central	230	14	6.1	(21)	(8.4)	(5)	(2.2)
South Atlantic	2,695	108	4.0	282	11.7	130	4.8
Mountain	214	14	6.5	8	3.9	3	1.4
West N. Central	168	1	0.6	(3)	(1.8)	8	4.8
New England	54	2	3.7	2	3.9	2	3.7
East S. Central	7,128	19	0.3	138	2.0	123	1.7
Total	12,637	168	1.3	401	3.3	286	2.3
[CIVIL ENGINEERS]							
U.S. Gen./multireg.	327	1	0.3	(2)	(0.5)	5	1.3
Pacific	3,250	115	3.5	79	2.5	95	2.9
East N. Central	988	27	2.7	16	1.7	1	1.8
Mid-Atlantic	1,582	2	0.1	(13)	(7.9)	(72)	(4.6)
West S. Central	1,463	50	3.4	6	0.4	7	0.5
South Atlantic	3,320	52	1.6	164	5.2	26	0.8
Mountain	600	29	4.8	34	6.0	36	6.0
West N. Central	1,471	19	1.3	(29)	(1.9)	7	0.5
New England	940	25	2.7	21	2.3	10	1.1
East S. Central	8,199	117	1.4	189	2.4	242	3.0
Total	22,185	437	2.0	343	1.6	374	1.7

TABLE 3B (Continued)

EMPLOYERS OF ENGINEERS — ESTIMATES OF CHANGE IN ENGINEERING EMPLOYMENT BY REGION

	Engineers Employed as of 10/31/82	Openings Reported as of 10/31/82 Number	%	Growth 10/31/81-10/31/82 Number	%	Estimated Growth 10/31/82-10/31/83 Number	%
[ELECTRICAL ENGINEERS]							
U.S. Gen./multireg.	180	2	1.1	8	4.7	6	3.3
Pacific	2,805	175	6.2	250	9.8	390	13.9
East N. Central	2,923	320	11.0	399	15.8	260	8.9
Mid-Atlantic	3,191	177	5.6	67	2.0	69	2.2
West S. Central	8,384	377	4.5	246	3.0	326	3.9
South Atlantic	4,397	197	4.5	138	3.2	194	4.4
Mountain	1,886	123	6.5	14	0.8	49	2.6
West N. Central	967	84	8.7	31	3.3	101	10.4
New England	736	22	3.0	75	11.4	80	10.9
East S. Central	16,809	315	1.9	899	5.7	806	4.8
Total	42,278	1,794	4.2	2,122	5.3	2,281	5.4
[INDUSTRIAL ENGINEERS]							
U.S. Gen./multireg.	36	0	0.0	5	16.1	5	13.9
Pacific	316	8	2.5	10	3.3	12	3.8
East N. Central	491	30	6.1	(23)	(4.5)	4	0.8
Mid-Atlantic	108	1	0.9	1	0	(1)	(0.9)
West S. Central	840	66	7.9	23	2.8	42	5.0
South Atlantic	371	22	5.9	42	12.8	30	8.1
Mountain	17	0	0.0	1	6.3	0	0.0
West N. Central	119	0	0.0	(1)	(0.8)	2	1.7
New England	96	5	5.2	13	15.7	8	8.3
East S. Central	2,320	34	1.5	165	7.7	3	0.1
Total	4,714	166	3.5	236	5.3	105	2.2
[MECHANICAL ENGINEERS]							
U.S. Gen./multireg.	280	4	1.4	0	0.0	1	0.0
Pacific	1,730	86	5.0	96	5.9	168	9.7
East N. Central	4,229	95	2.3	85	2.1	58	1.4
Mid-Atlantic	1,816	88	4.9	24	1.3	6	0.3
West S. Central	3,529	167	4.7	(61)	(1.7)	52	1.5
South Atlantic	5,588	390	7.0	429	8.3	200	3.6
Mountain	1,153	59	5.1	10	0.9	19	1.7
West N. Central	397	13	3.3	4	1.0	28	7.1
New England	772	16	2.1	83	12.1	55	7.1
East S. Central	17,178	229	1.3	481	2.9	596	3.5
Total	36,672	1,147	3.1	1,151	3.2	1,182	3.2

Comparison of Trend Expectations:

Tables 4A-1 and 4A-2 compare expectations of individuals and employers by branch of engineering.

By and large, employers expect the overall growth from 1982 to 1983, as from 1981 to 1982, to be made up of college hires, while experienced engineers hired will nearly balance separations. The exception to this lies in the poorly-defined "all others" group, which

includes a high proportion of engineers reported without degrees, the results from a few companies where no estimates of discipline breakdown were reported, and the group which includes other recognized disciplines.

Data from industrial engineers seem to be more optimistic than data from employers. Civil engineers are the most pessimistic, and a larger percentage of them forecast a decline, as do their employers.

TABLE 4A-1
EMPLOYMENT TRENDS BY BRANCH
OF ENGINEERING

	Individual Engineers Trend Viewpoint			Employers Net Experienced Hires			
	Rise	Decline	Seeking	1983E/1982R		1982R/1981R	
	%	%	%	No.	%	No.	%
Chemical (AIChE)*	20.4	29.6	4.6	78	0.6	(98)	(0.8)
Civil (ASCE)	15.4	29.9	15.4	(177)	(0.8)	(389)	(1.8)
Electrical (IEEE)	40.5	14.6	10.9	193	0.5	(238)	(0.6)
Industrial (AIIE)	34.1	21.7	17.8	(43)	(0.9)	(44)	(1.0)
Mechanical (ASME)	28.4	21.6	14.9	(86)	(0.2)	(573)	(1.6)
Overall	27.7	20.4	14.3	677	0.5	(1764)	(1.3)

*non-representative sample

NOTES: 83E—estimated for 10/31/82 to 10/31/83

82R—reported actual for 10/31/81 to 10/31/82

81R—reported actual for 10/31/80 to 10/31/81

()—denotes negative value

TABLE 4A-2
NET HIRES BY
BRANCH OF ENGINEERING

	(% of Engineers Employed)				Net Total	
	Experienced		College		83E/82R	82R/81R
	83E/82R	82R/81R	83E/82R	82R/81R		
Chemical	0.6	(0.8)	1.7	4.1	2.3	3.3
Civil	(0.8)	(1.8)	2.5	3.4	1.7	1.6
Electrical	0.5	(0.6)	4.9	5.9	5.4	5.3
Industrial	(0.9)	(1.0)	3.1	6.3	2.2	5.3
Mechanical	0.2	(1.6)	3.5	4.9	3.2	3.2
All Other	3.2	(2.0)	7.7	8.6	10.9	6.6
Overall	0.5	(1.3)	4.2	5.5	4.7	4.2

NOTES: 83E—estimated for 10/31/82 to 10/31/83

82R—reported actual for 10/31/81 to 10/31/82

81R—reported actual for 10/31/80 to 10/31/81

()—denotes negative value

As shown in Table 4B-1, more engineers (32.1%) foresee a decline in demand in their region than foresee a rise (21%). On the whole, employers foresee stability (0.5% growth) in demand for experienced engineers. On the other hand, engineers in the South Atlantic are somewhat more optimistic (employers are not). Employers in the Pacific are most optimistic (4.8% growth in experienced engineers), and employers in West South Central are most pessimistic (3.3% decline), while in both cases opinion among engineers is sharply divided.

Engineers in the North Central regions are among the most pessimistic, while employers in the West North Central foresee a turnaround from decline in 1983 to 2.55% growth in requirements for experienced engineers in 1983.

As shown in Table 4B-2, employers in the Pacific and New England regions show highest growth and the Mid-Atlantic least. West South Central calls for high turnover—a strong growth from college hiring and a decline in experienced employment.

As shown in Appendix B2-A, employers expect to hire experienced engineers in 1983 equivalent to 4.6% of their work force. On the other hand, 14.3% of the engineers surveyed are seeking employment.

Overall both employers and individual engineers indicate that employment of experienced engineers will be stable in 1983 (rather than declining as in 1982). However, hiring of engineers from colleges will be at a lower rate than in 1982 in almost all regions.

TABLE 4B-1
REGIONAL EMPLOYMENT TRENDS

	Count	Individual Engineers Trend Viewpoint			Number of Employers Surveyed	Employers Net Experienced Hires			
		% Rise	% Decline	% Seeking		1983E/1982R		1982R/1981R	
						No.	%	No.	%
U.S. Gen./multireg.	26	15.4	30.5	11.5	16	18	0.8	(186)	(8.5)
Pacific	398	28.1	30.2	15.1	30	521	4.8	(32)	(0.3)
East N. Central	464	11.9	40.5	13.4	75	8	0.1	34	0.3
Mid-Atlantic	491	17.1	36.5	14.3	53	(127)	(1.4)	(218)	(2.4)
West S. Central	181	27.6	26.0	12.7	19	(511)	(3.2)	(819)	(5.1)
South Atlantic	358	29.1	21.8	13.1	33	84	0.4	99	0.6
Mountain	156	25.0	28.9	13.5	18	(41)	(0.9)	(93)	(2.2)
West N. Central	183	13.1	39.3	15.9	41	92	2.5	(105)	(2.9)
New England	183	26.2	26.8	16.9	25	44	1.5	(17)	(0.6)
East S. Central	116	16.4	27.6	16.4	18	589	1.0	(427)	(0.7)
Overall	2592	21.0	32.1	14.3	333	677	0.5	(1764)	(1.3)

NOTES: 83E—estimated for 10/31/82 to 10/31/83

82R—reported actual for 10/31/81 to 10/31/82

81R—reported actual for 10/31/80 to 10/31/81

()—denotes negative value

TABLE 4B-2
REGIONAL NET HIRES

	% of Engineers Employed					
	Experienced		College		Net Total	
	83E/82R	82R/81R	83E/82R	82R/81R	83E/82R	82R/81R
U.S. Gen./multireg.	0.8.	(8.5)	3.3	7.0	4.2	(1.6)
Pacific	4.8	(0.3)	4.5	5.1	9.3	4.8
East N. Central	0.1	0.3	3.5	5.2	3.6	5.5
Mid-Atlantic	(1.4)	(2.4)	1.5	1.8	0.1	(0.6)
West S. Central	(3.2)	(5.1)	5.3	5.2	2.0	0.1
South Atlantic	0.4	0.6	4.5	8.2	4.9	8.8
Mountain	(0.9)	(2.2)	4.0	2.7	3.0	0.5
West N. Central	2.5	(2.9)	3.2	3.4	5.6	0.5
New England	1.5	(0.6)	4.8	8.8	6.3	8.1
East S. Central	1.0	(0.7)	4.5	5.5	5.5	4.8
Overall	0.5	(1.3)	4.2	5.5	4.7	4.2

NOTES: 83E—estimated for 10/31/82 to 10/31/83.
82R—reported actual for 10/31/81 to 10/31/82
81R—reported actual for 10/31/80 to 10/31/81
()—denotes negative value

B. Make-up of the Samples

Highest Degree:

Table 5 illustrates the distribution of engineers in terms of highest degree reported by the individual engineer (overall), the individual engineer subset of those seeking new engineering employment, and by employers of engineers.

Employer respondents to the question reported bachelor's as the highest degree for over half of their engineering employees. Individual engineers sampled were, on the average, more highly educated than those in the employer reports. This was, in part, because of the small sampling of educational institutions among employers. Job seekers appeared particularly concentrated at the master's and engineer professional levels.

Thirty-nine percent of the individual respondents indicated they were registered professional engineers.

This is slightly less than the 41% implied by the 1981 report of the National Council of Engineering Examiners which includes duplicate registrations. However, only 30% of the engineers seeking employment were registered.

Work Location:

Table 6 shows the geographic distribution of the individual engineer respondents and the responding employers.

While the geographic distribution of employer respondents roughly paralleled that of the individual engineers, the distribution of the number of employees represented by responding employers was distorted by large employers in the East South Central region and by small employers in the Middle Atlantic and East North Central regions.

TABLE 5
HIGHEST DEGREE EARNED
As Reported By:

	Individual Engineers FORM A (% of replies)	Engineering Employers FORM B	
	All Returns	Seeking Engineering Employment	% Engineers Employed
B.S.	46.1	44.7	69.8
M.S.	22.0	19.6	16.0
Engr.	4.1	2.8	N/A
Ph.D.	11.9	13.4	4.7
Assoc.	1.9	2.5	N/A
No Degree	0.2	0.6	9.5
No Answer	13.8	16.5	N/A
Total	100.0	100.0	100.0

TABLE 6
GEOGRAPHICAL DISTRIBUTION OF RESPONDENTS

	Individual Engineers FORM A	Engineering Employer FORM B	
	% <u>of Replies</u>	% <u>No. Employers</u>	% of Engineers <u>Employed</u>
Mid-Atlantic	19	17	6
East N. Central	18	23	8
Pacific	15	9	8
South Atlantic	14	10	13
New England	7	8	2
West N. Central	7	12	3
West S. Central	7	6	11
Mountain	6	5	3
East S. Central	4	5	14
U.S. Gen./multireg.	1	5	2
Other & No Answer	2	—	—
Total	100%	100%	100%
Number of Replies	2592	333	140690

Size of Work Force:

Most engineers responding were from organizations having 100 or fewer engineers. Most of the 273 employers sampled also had fewer than 100 engineering employees. However, as shown in Table 7A, the largest number of employers were in the 10-99 engineering

employee range, but represented only 5% of the engineers employed.

Generally, more job-seekers were to be found among smaller employers both on an engineers employed basis (< 100 engineers employed, Table 7A) and on a total workforce basis (< 100 total employees, Table 7B).

TABLE 7A
SIZE OF ENGINEERING WORK FORCE

	Individual Engineers		Engineering Employer FORM B Composite	
	FORM A (Comprehensive) (2,592)* % of Respondents	FORM A (Seeking Engineering Employment) (322)*	% Employers (333)*	% Engineer Employees (140,690)*
> 1000	15.6	13.4	6.3	70.8
1000-100	25.3	22.1	28.1	23.8
99-10	29.4	30.1	51.8	5.2
< 10	20.7	25.2	13.8	0.2
Self-employed	5.1	4.4	—	—
No Answer	3.9	5.0	—	—

* actual count

TABLE 7B
SIZE OF TOTAL WORK FORCE

	Individual Engineers		Engineering Employer FORM B Composite	
	FORM A (Comprehensive) (2,592)* % of Respondents	FORM A (Seeking Engineering Employment) (322)*	% Employers (333)*	% Engineer Employees (140,690)*
> 1000	18.6	14.3	42.5	92.3
1000-100	32.3	32.0	43.7	6.8
99-10	26.2	29.8	12.9	0.9
< 10	14.8	15.5	0.9	—
Self-employed	—	—	—	—
No Answer	8.1	8.4	—	—

* actual count

Types of Employing Organizations:

Both the individual engineers and the employers were asked to identify the principal activity of their organization. The distribution of these principal activities is shown in Table 8A.

Correlation between distributions of individuals and of employers is fair. Consultants, educational institutions, and ceramics are represented more strongly among individuals. Construction, communication services,

aerospace, and chemicals-drugs are represented more strongly among employers primarily because of sampling of large organizations.

As shown in Table 8B, job seeking is particularly strong among individuals in consulting, metal products, engineering services, and construction while it seems weaker among individual engineers in utilities, ceramics-glass-cement, and the federal government.

TABLE 8A
ACTIVITY OF EMPLOYING ORGANIZATION

	Individual Engineers	Engineering Employers	
	FORM A (Comprehensive) (% of Replies)	FORM B (Employers- % of Total)	FORM B (No. of Engrs.- % of Total)
Consultants	13.7	11.4	4.0
Federal Gov't.	6.9	3.6	3.3
State Gov't.	1.5	5.4	5.0
Local Gov't.	1.5	3.0	0.6
Educational Inst.	7.1	3.6	0.6
Electronic Equip. & Comp.	6.7	7.5	3.3
Chemicals & Drugs	2.3	3.9	7.8
Utilities	5.6	13.2	9.1
Aerospace	7.9	3.9	15.3
Engrg. Services	3.0	1.2	2.3
Construction	2.9	2.7	12.2
Metal Products	3.9	7.5	2.1
Petroleum	1.3	1.5	4.6
Ceramics, Glass, Cement	10.6	1.2	0.1
Other Manufacturing	6.1	7.8	a
Machinery (other than Elect.)	2.7	3.9	0.4
Research Org. & Labs.	1.9	2.7	2.7
Rubber & Plastic Prod.	1.0	1.8	0.1
Food Products	1.0	0.6	0.0
Communications Services	1.6	1.5	9.8
Auto & RR Equip.	2.1	2.7	0.5
Electrical Machinery	2.7	3.0	2.8
Basic Metals	2.2	0.3	0.0
Other, Not Specified	3.4	3.9	13.4
Total	100.0	100.0	100.0

NOTE: a—included in Other, Not Specified

TABLE 8B

CONTRAST IN JOB-SEEKING BY EMPLOYING ORGANIZATION
% DISTRIBUTION OF ENGINEERS IN SAMPLE SUBSET

	Seeking	Not Seeking	Overall	Points Difference	
				+	-
Consultants	16.5	13.1	13.7	3.4	
Ceramics, Glass, Cement	9.6	10.8	10.6		1.2
Aerospace	7.4	8.3	7.9		0.9
Electronic Equip't. & Comp.	6.8	6.8	6.7	—	—
Colleges & Universities	6.2	6.8	6.7		0.6
Federal Gov't.	5.9	7.1	6.9		1.2
Metal Prod.	5.9	3.5	3.9	2.4	
Engrg. Services	5.0	2.8	3.0	2.2	
Construction	4.0	2.7	2.9	1.3	
Machinery (other than Elect.)	3.4	2.7	2.7	0.7	
Electrical Utilities	3.1	4.9	4.9		1.8
Auto & RR Equip't.	2.5	2.1	2.1	0.4	
Elect. Machinery	2.5	2.5	2.7	—	—
Basic Metals	2.2	2.2	2.2	—	—
Research Org. & Labs	2.2	1.9	1.9	0.3	
Chemicals & Drugs	1.9	2.2	2.3		0.3
State Gov't.	1.9	1.5	1.5	0.4	
Rubber & Plastic Prod.	1.6	0.9	1.0	0.7	
Local Gov't.	1.2	1.6	1.5		0.4
Communications Services	0.9	1.6	1.6		0.7
Other Manufacturing	4.3	7.6	7.2		3.3
Other Non-manufacturing	5.0	6.4	6.1		1.4
Total	100.0	100.0	100.0	11.8	11.8

Distribution Among Branches of Engineering:

As shown in Table 9A, NSF estimates of the distribution of the total engineering population lie between the distributions for the individual engineer and employer samples, except for the chemical engineering survey, for which our sample is small and probably defective.

Industry appears to under-report industrial and "other" engineers. The sample of individual engineers was intentionally biased to obtain more valid samples from smaller engineering societies.

Table 9B examines some of these biases relative to the

proportion of engineers forecasting a rise in demand in their profession. From Table 2B the overall proportion is 27.74%. For four large societies, as shown in Table 9B, the proportion from the sample is 27.95%. Weighting by society size, employer sample distribution, and by NSF estimated engineering population employed in science and technology provided estimates of 29.62, 29.45 and 28.58 percent respectively. This compares with a 95% confidence range computed from five subset samples of 26.4 to 29.1%. Hence, at least for forecasts of rise, weighting might make a small, though statistically significant, change.

TABLE 9A

DISTRIBUTION AMONG BRANCHES OF ENGINEERING

	FORM A Individual Engineers % of Replies	FORM B Employee Composite % of Engineers Employed	% U.S. Total Engineering Population**
Chemical (AIChE)	1.7*	9.0	5.3
Civil (ASCE)	14.1	15.8	14.1
Electrical (IEEE)	14.6	30.0	19.2
Industrial (AIIE)	5.0	3.3	in "Other"
Mechanical (ASME)	15.5	26.1	17.5
Other	49.1	15.8	43.2
Total	100.0	100.0	100.0

*non-representative sample

**based on "U.S. Scientists and Engineers 1981—Detailed Statistical Tables, Estimated Total Engineering Employment in Science or Engineering." Private communication, Dr. Alan Fechter, NSF.

TABLE 9B

WEIGHTING COMPARISON Proportion Forecasting Rise in Profession

	Survey	Society Membership	Society Weight	Employer Distribution	Employer Weight	NSF Distribution	NSF Weight
AIChE	20.45%	43,001	8,793.70	12,637	2,584.27	72,700	14,867.15
ASCE	15.38	67,215	10,337.67	22,185	3,412.05	185,600	28,545.28
IEEE	40.48	133,316	53,966.32	42,278	17,114.13	260,000	105,248.00
ASME	28.36	76,357	21,654.85	36,672	10,400.18	237,100	65,539.96
Total		319,889	94,752.54	113,772	33,510.64	749,400	214,200.39
Overall	27.95%		29.62%		29.45%		28.58%

NOTE: "Weight" = Survey percent x (membership or distribution)

e.g., $20.45 \times 72,700 = 14,867.15$

"Overall" = $100 \times \text{weight} / (\text{membership or distribution})$

e.g., $100 \times 214,200.39 / 749,400 = 28.58\%$

C. Comments on Samples and Trends

As noted above, significant differences do exist between samples of responses from individual engineer respondents and employers, as well as between individuals seeking new engineering employment and those not seeking such employment.

Some of the factors which may be responsible for these differences include the attempt to include a reasonable sample of all AAES member societies, the inevitable self-selection among respondents (both individual and employer), and the large size of many employers. Sufficient society, regional, and industry detail is given, however, so that weighted demand forecasts for many hypothesized alternate populations are feasible.

In addition, as noted in Appendix D1, the current sample make-up appears somewhat different from the 1981 survey sample. The major flaw in the current study is the inadequate sample of individual chemical

engineers, but some other differences are significant.

Certainly, therefore, forecasts of demand (like other forecasts) must be interpreted with caution.

Nonetheless, certain implications of this study are worthy of consideration:

1. Generally, growth of demand for engineers in 1983 will be very low, although better than for 1982 where demand for experienced engineers declined.
2. Strong differences in patterns of demand by region and discipline exist, as might be expected, but differences in employer and individual engineer perceptions of these patterns sometimes differ significantly.
3. A greater proportion of experienced engineers are seeking employment than employers are planning to hire. It is interesting to note that those seeking include typical proportions both of those who are optimistic that demand is growing and those who anticipate demand will decline.

AAES**AMERICAN ASSOCIATION OF ENGINEERING SOCIETIES, INC.**

345 EAST 47th STREET • NEW YORK, NEW YORK 10017 • TELEPHONE 212-705-7840

MEMBER SOCIETIES

American Society of
Civil Engineers
American Institute of
Mining, Metallurgical
& Petroleum Engineers, Inc.
The American Society of
Mechanical Engineers
The Institute of
Electrical & Electronics
Engineers
American Society for
Engineering Education
American Society of
Heating, Refrigerating &
Air Conditioning
Engineers, Inc.
American Society of
Agricultural Engineers
American Institute of
Chemical Engineers
American Society
for Metals
National Council of
Engineering Examiners
Society of
Manufacturing Engineers
American Institute of
Aeronautics & Astronautics
National Society of
Professional Engineers
National Institute of
Ceramic Engineers
Society of Allied
Weight Engineers, Inc.
Society of Plastics
Engineers, Inc.
American Society for
Quality Control
Standards Engineering Society
American Institute of
Industrial Engineers, Inc.
Society of
Women Engineers
Society of Fire
Protection Engineers
American Institute of
Plant Engineers
American Nuclear Society
American Academy of
Environmental Engineers
American Association of
Cost Engineers
System Safety Society
Association of
Energy Engineers
American Indian Science
& Engineering Society

ASSOCIATE SOCIETIES

The Tau Beta Pi
Association, Inc.
Air Pollution
Control Association
American Council of
Independent Laboratories, Inc.
American Congress on
Surveying & Mapping
National Association of
Corrosion Engineers
Federation of
Materials Societies
National Action Council for
Minorities in Engineering, Inc.

REGIONAL SOCIETIES

Western Society
of Engineers
The Cleveland
Engineering Society
Engineering Society
of Detroit
Washington Society
of Engineers
Colorado Society
of Engineers
Colorado Engineering Council
Engineering Societies
of New England, Inc.
Quad Cities Engineering
& Scientific Council

April 8, 1983

Executive Summary**ENGINEERING DEMAND GROWTH SLOWED**

The proportion of engineers expecting demand for engineers to grow in 1983 has dropped sharply from last year. On the other hand, employers of engineers predict that net hiring (hiring less separations) will be slightly higher in 1983 than in 1982. They report that the rate of separation will reduce faster than the reduction in college hiring, while the hiring rate for experienced engineers holds steady. Thus, both practicing engineers and their employers predominantly foresee steadier employment levels rather than a period of strong growth or decline.

Growth is expected to be strongest for electrical engineers. Demand for civil engineers is anticipated to be appreciably below average for the second consecutive year. Engineers employed in aerospace, electronic equipment, and computers are relatively optimistic about growth in their industries.

Level of activity in engineering employment is expected to vary by region. Employers in the Pacific, New England, West North Central, and East South Central states predicted moderate to strong growth in 1983, while employers in the Mountain, West South Central, and Mid-Atlantic states are forecasting net reductions in employment levels of experienced engineers.

REPRESENTING NEARLY ONE MILLION ENGINEERS

APPENDIX A
SURVEY INSTRUMENTS

AAES**AMERICAN ASSOCIATION OF ENGINEERING SOCIETIES, INC.**

345 EAST 47th STREET • NEW YORK, NEW YORK 10017 • TELEPHONE 212-705-7840

MEMBER SOCIETIES

American Society of Civil Engineers
 American Institute of Mining, Metallurgical & Petroleum Engineers, Inc.
 The American Society of Mechanical Engineers
 The Institute of Electrical & Electronics Engineers
 American Society for Engineering Education
 American Society of Heating, Refrigerating & Air Conditioning Engineers, Inc.
 American Society of Agricultural Engineers
 American Institute of Chemical Engineers
 American Society for Metals
 National Council of Engineering Examiners
 Society of Manufacturing Engineers
 American Institute of Aeronautics & Astronautics
 National Society of Professional Engineers
 National Institute of Ceramic Engineers
 Society of Allied Weight Engineers, Inc.
 Society of Plastics Engineers, Inc.
 American Society for Quality Control
 Standards Engineering Society
 American Institute of Industrial Engineers, Inc.
 Society of Women Engineers
 Society of Fire Protection Engineers
 American Institute of Plant Engineers
 American Nuclear Society
 American Academy of Environmental Engineers
 American Association of Cost Engineers
 System Safety Society
 Association of Energy Engineers
 American Indian Science & Engineering Society

ASSOCIATE SOCIETIES

The Tau Beta Pi Association, Inc.
 Air Pollution Control Association
 American Council of Independent Laboratories, Inc.
 American Congress on Surveying & Mapping
 National Association of Corrosion Engineers
 Federation of Materials Societies
 National Action Council for Minorities in Engineering, Inc.

REGIONAL SOCIETIES

Western Society of Engineers
 The Cleveland Engineering Society
 Engineering Society of Detroit
 Washington Society of Engineers
 Colorado Society of Engineers
 Colorado Engineering Council
 Engineering Societies of New England, Inc.
 Quad Cities Engineering & Scientific Council

Engineering Manpower Commission
[212] 705-7846

November, 1982

Dear Colleague:

The Engineering Manpower Commission (EMC) of the American Association of Engineering Societies (AAES) is conducting its second annual study of short-term demand for engineers. Your organization has been selected to participate in the 1982 demand survey. We sincerely hope you will agree to participate. In this study, EMC surveys engineers and employers of engineers to record their view of near-term (one-year) demand.

No attempt will be made to correlate an individual engineer's response with his or her employer's response; in fact, we have no other information about the participating engineers other than that they belong to a society that is a member of AAES. Furthermore, we assure you that your company's questionnaire will also be held in the strictest confidence. Your information will be used only as a contribution to the data pool collected from other employers.

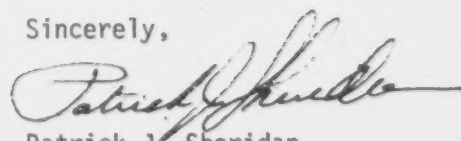
If by chance you are not the proper person in your company to respond to this survey, please forward this correspondence to the responsible party.

We recognize the time and effort required to complete this form, and have tried to simplify it to facilitate your response. In appreciation for your cooperation, I am pleased to offer participants in the 1982 survey the opportunity to purchase the results of the 1981 survey, Demand for Engineers, for \$20. (This book regularly sells for \$35.)

I have enclosed a brief summary of the 1981 report for your information, and an order form for your convenience.

If you have any questions or need assistance, please do not hesitate to call me at (212) 705-7104.

Sincerely,



Patrick J. Sheridan
 Director
 Manpower Activities

REPRESENTING NEARLY ONE MILLION ENGINEERS

ENGINEERING MANPOWER COMMISSION
of the
AMERICAN ASSOCIATION OF ENGINEERING SOCIETIES, INC.

Survey of Engineering Employment and Demand

Employment Group Number _____ (see instruction A)

Date: _____

1. Employed location zip code: _____ Region Number: _____ (see instruction B).
2. Professional society affiliation(s) _____
(Please list all, in order of preference.)
3. Year of Bachelor's Degree: _____
(Please indicate regardless of field of study)
4. Highest degree attained: (Check one)

	Engineering	Other than Engineering
a. PhD	_____	_____
b. Engineer	_____	_____
c. Masters	_____	_____
d. Bachelors	_____	_____
e. Associate	_____	_____
f. Other	_____	_____

5a. Registered PE? Yes _____ No _____

5b. OPTIONAL

M ☐

F ☐

Minority _____

6. Employment Status and Prospects:

	Status as of 10/31/81 (check one or more as appropriate)	Status as of 10/31/82 (check one or more as appropriate)	Expected status next year (check one or more as appropriate)
a. Fully Employed - Engineering (Including Teaching & Engineering Management)	☐	☐	☐
b. Fully Employed - Engineering - related assignment (Sales Engineer, Production Supervisor, etc.)	☐	☐	☐
c. Fully Employed - Non-engineering Assignment (Sales, Personnel, Accounting, etc.)	☐	☐	☐
Nature of Non-engineering Work _____			
d. Partially Employed - Engineering Assignment (25 hours per week or less)	☐	☐	☐
e. Partially Employed - Engineering - related assignment (25 hours per week or less)	☐	☐	☐
f. Partially Employed - Non-engineering Assignment	☐	☐	☐
Nature of Non-engineering Work _____			
g. Unemployed (not retired)	☐	☐	☐
h. Retired	☐	☐	☐
i. Other (please state) _____			

APPENDIX A

7. Base Annual Salary:

Last year: \$ _____ This Year: \$ _____ Anticipated 1983: \$ _____
 (10/31/81) (10/31/82) (10/31/83)

8a. Engineers Employed (Check One)
(In local area for your company or division)

More than 1000 _____
 1000 - 100 _____
 100 - 10 _____
 Under 10 _____
 Self Employed _____

8b. Total Employment (Check One)
(In local area for your company or division)

More than 5000 _____
 5000 - 500 _____
 500 - 50 _____
 Under 50 _____

9a. Are you actively seeking new or changed employment? Yes _____ No _____

9b. In the field of engineering? Yes _____ No _____

10. In your opinion, over the next year do you anticipate that engineering employment will:

(a) In your professional discipline, (such as civil engineering, mechanical engineering, etc.) (Check one)

RISE _____ → ☐ Planned Growth —or— ☐ Current Staff Shortages
 REMAIN STEADY _____ → ☐ Normal Turnover —or— ☐ Company Consolidation
 DECLINE _____ → ☐ Economic Uncertainties —or— ☐ Contract Completion

REASON: (Check one) if applicable

(b) In your local area (Check one)

RISE _____ → ☐ Planned Growth —or— ☐ Current Staff Shortages
 REMAIN STEADY _____ → ☐ Normal Turnover —or— ☐ Company Consolidation
 DECLINE _____ → ☐ Economic Uncertainties —or— ☐ Contract Completion

REASON: (Check one) if applicable

(c) In your company, government agency, or institution (Check one)

RISE _____ → ☐ Planned Growth —or— ☐ Current Staff Shortages
 REMAIN STEADY _____ → ☐ Normal Turnover —or— ☐ Company Consolidation
 DECLINE _____ → ☐ Economic Uncertainties —or— ☐ Contract Completion

REASON: (Check one) if applicable

11. Confidence level of your opinion in Question 10: (Check one)

REASONABLY FIRM _____ GOOD ESTIMATE _____ EDUCATED GUESS _____

12. (Optional) Other comments on engineering employment relative to demand prospects, quality, etc.:

Thank you for your cooperation. Please return no later than November 30, 1982

(Enclosed envelope)

Engineering Manpower Commission
 345 East 47th Street
 New York, New York 10017

Survey of Engineering Employment and Demand

INSTRUCTIONS

A. Select Employment Group No. from the following list, and specify **only one group** per form.

- | | |
|--|---|
| 01. Aerospace | 20. Communication services |
| 02. Automotive & Railroad equipment | 21. Construction |
| 03. Ceramic products, stone, clay, glass, cement | 22. Consultants (engineering & architectural) |
| 04. Chemicals, drugs | 23. Engineering services (other) |
| 05. Electrical machinery & equipment | 24. Mining |
| 06. Electronic equipment & computers | 25. Independent research organizations & laboratories |
| 07. Food products | 26. Transportation services |
| 08. Instruments (precision) | 27. Electric Utilities |
| 09. Lumber & wood products | 28. Gas Utilities & pipelines |
| 10. Machinery (other than electrical) | 29. Federal Government |
| 11. Metal products (fabricated) | 30. State Government |
| 12. Metals (basic) | 31. Local Government |
| 13. Ordnance | 32. Colleges & Universities |
| 14. Paper Products | 33. Technical Institutions & Junior Colleges |
| 15. Petroleum | 34. Professional Societies & Non-Profit Institutions |
| 16. Rubber & plastic products (fabricated) | 35. Water Utilities |
| 17. Shipbuilding | 36. Other Manufacturing |
| 18. Textile products | 37. Other Non-Manufacturing |
| 19. Business, trade, publishing | |

B. If data are **primarily** from one or two regional areas, please indicate the appropriate regional number (or numbers).

REGION

1. **New England**
Connecticut
Maine
Massachusetts
New Hampshire
Rhode Island
Vermont
2. **Middle Atlantic**
New Jersey
New York
Pennsylvania
3. **East North Central**
Illinois
Indiana
Michigan
Ohio
Wisconsin
4. **West North Central**
Iowa
Kansas
Minnesota
Missouri
Nebraska
North Dakota
South Dakota
5. **South Atlantic**
Delaware
District of Columbia
Florida
Georgia
Maryland
North Carolina

REGION

5. **South Atlantic** (continued)
South Carolina
Virginia
West Virginia
6. **East South Central**
Alabama
Kentucky
Mississippi
Tennessee
7. **West South Central**
Arkansas
Louisiana
Oklahoma
Texas
8. **Mountain**
Arizona
Colorado
Idaho
Montana
Nevada
New Mexico
Utah
Wyoming
9. **Pacific**
Alaska
California
Hawaii
Oregon
Washington
10. **U.S. General or Multi-Regions**
11. **Puerto Rico**
12. **Canal Zone**
13. **Non-U.S.**

FORM-B

ENGINEERING MANPOWER COMMISSION
of the
AMERICAN ASSOCIATION OF ENGINEERING SOCIETIES, INC.

SURVEY OF ENGINEERING EMPLOYMENT AND DEMAND

October, 1982
(Confidential Status)

Return by November 30, 1982
(Envelope Enclosed)

Engineering Manpower Commission
345 East 47th Street
New York, New York 10017

Contact Name: _____

Title: _____

Company: _____

Street or P.O. Box: _____

City: _____ State _____ Zip _____ Phone _____

III. NUMBER OF HIRES AND SEPARATIONS

Over the period 10/31/81 to 10/31/82

	<u>ChE</u>	<u>Civil</u>	<u>Elec.</u>	<u>Indust.</u>	<u>Mech.</u>	<u>Other Major Displ. *()</u>	<u>All Other</u>	<u>Total</u>
a. College Hires	_____	_____	_____	_____	_____	_____	_____	_____
b. Experienced Hires	_____	_____	_____	_____	_____	_____	_____	_____
c. Total Hires (a+b)	_____	_____	_____	_____	_____	_____	_____	_____
d. Total Separations	_____	_____	_____	_____	_____	_____	_____	_____
e. Net Change (c minus d)	_____	_____	_____	_____	_____	_____	_____	_____

IV. YOUR FORECAST NUMBER OF HIRES & SEPARATIONS

From 10/31/82 to 10/31/83

	<u>ChE</u>	<u>Civil</u>	<u>Elec.</u>	<u>Indust.</u>	<u>Mech.</u>	<u>Other Major Displ. *()</u>	<u>All Other</u>	<u>Total</u>
a. College Hires	_____	_____	_____	_____	_____	_____	_____	_____
b. Experienced Hires	_____	_____	_____	_____	_____	_____	_____	_____
c. Total Hires (a+b)	_____	_____	_____	_____	_____	_____	_____	_____
d. Total Separations	_____	_____	_____	_____	_____	_____	_____	_____
e. Net Change (c minus d)	_____	_____	_____	_____	_____	_____	_____	_____

***Please Specify; Example: Aero**

V. CONFIDENCE LEVEL OF DATA REPORTED IN QUESTION IV

(Please check one)

REASONABLY FIRM _____ BEST ESTIMATE _____ EDUCATED GUESS _____

VI. COMMENTS RELATING TO DATA REPORTED IN QUESTION IV (OR GENERAL COMMENTS)

APPENDIX A

Survey of Engineering Employment and Demand

INSTRUCTIONS

A. Select Employment Group No. from the following list, and specify **only one group** per form.

- | | |
|--|---|
| 01. Aerospace | 20. Communication services |
| 02. Automotive & Railroad equipment | 21. Construction |
| 03. Ceramic products, stone, clay, glass, cement | 22. Consultants (engineering & architectural) |
| 04. Chemicals, drugs | 23. Engineering services (other) |
| 05. Electrical machinery & equipment | 24. Mining |
| 06. Electronic equipment & computers | 25. Independent research organizations & laboratories |
| 07. Food products | 26. Transportation services |
| 08. Instruments (precision) | 27. Electric Utilities |
| 09. Lumber & wood products | 28. Gas Utilities & pipelines |
| 10. Machinery (other than electrical) | 29. Federal Government |
| 11. Metal products (fabricated) | 30. State Government |
| 12. Metals (basic) | 31. Local Government |
| 13. Ordnance | 32. Colleges & Universities |
| 14. Paper Products | 33. Technical Institutions & Junior Colleges |
| 15. Petroleum | 34. Professional Societies & Non-Profit Institutions |
| 16. Rubber & plastic products (fabricated) | 35. Water Utilities |
| 17. Shipbuilding | 36. Other Manufacturing |
| 18. Textile products | 37. Other Non-Manufacturing |
| 19. Business, trade, publishing | |

B. If data are **primarily** from one or two regional areas, please indicate the appropriate regional number (or numbers).

REGION	REGION	REGION	REGION
1. New England	4. West North Central	5. South Atlantic (continued)	8. Mountain
Connecticut	Iowa	North Carolina	Arizona
Maine	Kansas	South Carolina	Colorado
Massachusetts	Minnesota	Virginia	Idaho
New Hampshire	Missouri	West Virginia	Montana
Rhode Island	Nebraska		Nevada
Vermont	North Dakota	6. East South Central	New Mexico
2. Middle Atlantic	South Dakota	Alabama	Utah
New Jersey	5. South Atlantic	Kentucky	Wyoming
New York	Delaware	Mississippi	
Pennsylvania	District of Columbia	Tennessee	9. Pacific
3. East North Central	Florida	7. West South Central	Alaska
Illinois	Georgia	Arkansas	California
Indiana	Maryland	Louisiana	Hawaii
Michigan		Oklahoma	Oregon
Ohio		Texas	Washington
Wisconsin			10. U.S. General or Multi-Regions
			11. Puerto Rico
			12. Canal Zone
			13. Non-U.S.

C. Degree level should be reported on basis of college education in engineering. Employees classified as engineers and doing work for which you would normally hire engineering graduates, but who do not hold at least a BS degree in engineering or closely related study, should be reported under "No Engr. Degree". In case of openings, show the degree level that would be *preferred*, assuming manpower is available.

D. Branch of engineering should be reported on the basis of **engineering job assignments**, which may not necessarily be the same as the individual's original education. Group related specialties under the most appropriate major branch. Combine miscellaneous specific fields under the "All Other" column. In the case of openings and new hires, show the specialty that would be *preferred*, assuming manpower is available. If your information is not broken down by discipline, please, at least, indicate totals.

APPENDIX B
PROCESSED DATA

INDIVIDUAL ENGINEER RESPONDENTS
TABLES

- B1-A Summary for Participating Societies and
Composite for all Individual Respondents
- B1-B Median Salaries by Degree Level - Individual
Respondents
- B1-C Average Salaries in 1982 By Decade Since
Bachelor's Degree - Individual Respondents

EMPLOYER RESPONDENTS
TABLES

- B2-A Demand For Engineers by Discipline - Employer
Respondents
 - B2-B Demand For Engineers by Region - Employer
Respondents
-

APPENDIX B

PROCESSED DATA

TABLE B1-A
SUMMARY FOR PARTICIPATING SOCIETIES AND COMPOSITE
(For All Individual Respondents)

		Composite (2592)*	ASME (402)*	IEEE (378)*	ASCE (365)*	NSPE (230)*	NICE (220)*
1. Academic & Professional Qualifications (%)	B.S.	46.1	51.7	47.1	53.8	54.2	40.0
	M.S.	22.0	25.1	22.2	31.9	26.2	22.7
	Engineer	4.1	4.5	5.2	3.6	5.7	2.7
	Ph.D.	11.9	12.4	12.2	8.0	7.0	21.4
	Assoc.	1.9	1.5	1.3	0.0	1.3	0.0
2. Employment Status 1982 (% fully employed)	Prof. Engr.	39.2	49.8	36.2	78.0	90.0	20.0
	Engineering	71.9	76.1	76.2	81.3	79.0	63.6
	Engrg. Rel.	12.1	11.9	6.4	5.5	10.0	16.4
3. Primary Location	Non-Engrg.	5.1	3.5	4.5	3.0	1.8	4.6
	Region	Mid-Atlantic	Mid-Atlantic	Pacific	Pacific	East-North Central	Mid-Atlantic
	Percentage	18.9	16.9	21.7	20.1	18.8	25.9
4. Primary Employer Group	Group	Consultants	Consultants	Electronic Equipmt. & Comp.	Consultants	Consultants	Ceramic Products
	Percentage	13.7	14.2	20.6	41.2	37.1	63.2
5. Are Most Likely Members of an Engineering Work Force Numbering...	Force	10-99	100-1000	100-1000	10-99	10-99	10-99
	Percentage	29.4	29.8	30.4	36.5	32.3	29.6
6. Reported Median Salaries in 1982	B.S.	\$41,418	\$34,360	\$45,220	\$30,833	\$38,000	\$36,150
	M.S.	\$44,033	\$43,600	\$48,000	\$43,300	\$41,967	\$36,900
	Ph.D.	\$48,293	\$40,000	\$47,200	\$48,000	\$44,500	\$44,333
7. Seeking New Employment	Percentage	14.3	14.9	10.8	15.4	8.3	18.6
	Seeking Engrg. Employment	Percentage	14.9	16.4	13.0	15.4	16.8
8. Employment Trend Viewpoints (%)							
a. Professional Discipline	Rise	27.7	28.4	40.5	15.5	21.0	31.4
	Steady	49.6	47.0	43.1	52.2	55.0	50.0
	Decline	20.4	21.6	14.6	29.9	23.1	16.4
b. Local Area	Rise	20.9	19.6	32.0	14.0	11.0	15.9
	Steady	44.1	38.1	45.2	46.4	46.7	49.6
	Decline	32.1	38.6	20.9	36.8	34.1	31.8
9. Confidence Level in Trend Viewpoint (%)	Firm	26.4	22.4	28.6	25.0	28.0	27.7
	Estimate	43.8	49.0	40.0	40.9	46.7	47.3
	Guess	29.9	28.6	31.5	34.1	25.3	25.0

*actual count

APPENDIX B

TABLE B1-A (Continued)

SUMMARY FOR PARTICIPATING SOCIETIES AND COMPOSITE
(For All Individual Respondents)

		Composite (2592)*	AIAA (160)*	ANS (142)*	ASM (135)*	AIIE (129)*	ASAE (124)*
1. Academic & Professional Qualifications (%)	B.S.	46.1	31.2	28.9	43.7	46.5	48.4
	M.S.	22.0	30.0	31.7	17.8	17.8	17.7
	Engineer	4.1	1.2	2.1	4.4	3.1	3.2
	Ph.D.	11.9	26.9	18.3	14.1	3.9	22.6
	Assoc.	1.9	0.6	0.0	3.7	1.6	0.8
	Prof. Engr.	39.2	30.0	32.4	25.2	25.6	43.6
2. Employment Status 1982 (% fully employed)	Engineering	71.9	81.9	83.1	69.6	75.2	74.2
	Engrg. Rel.	12.1	5.6	7.0	17.0	14.0	16.1
	Non-Engrg.	5.1	0.6	3.5	6.7	3.9	5.6
3. Primary Location		Mid-		South	East North	East North	East North
	Region	Atlantic	Pacific	Atlantic	Central	Central	Central
	Percentage	18.9	31.9	21.1	30.4	19.4	24.2
4. Primary Employer Group	Group	*Consultants	Aerospace	Electric Utilities	Metal Products (fab.)	Electronic Equipt. & Comp.	Machinery (other than Electric)
	Percentage	13.7	50.0	20.4	15.6	12.4	17.7
5. Are Most Likely Members of an Engineering Work Force Numbering...	Force	10-99	>1000	100-1000	10-99	10-99	<10
	Percentage	29.4	41.9	36.6	34.8	33.3	32.3
6. Reported Median Salaries in 1982	B.S.	\$41,418	\$45,233	\$42,500	\$35,500	\$33,867	\$32,000
	M.S.	\$44,033	\$54,450	\$44,600	\$36,500	\$36,000	\$28,333
	Ph.D.	\$48,293	\$46,924	\$47,800	\$50,000	\$38,600	\$41,500
7. Seeking New Employment	Percentage	14.3	16.2	12.7	19.2	17.8	12.9
	Seeking Engrg. Employment	Percentage	14.9	16.2	14.8	20.0	15.3
8. Employment Trend Viewpoints (%)							
a. Professional Discipline	Rise	27.7	35.0	33.1	26.7	34.1	16.1
	Steady	49.6	53.7	41.5	50.4	44.2	57.3
	Decline	20.4	10.6	24.6	20.0	21.7	24.2
b. Local Area	Rise	20.9	37.5	18.3	20.7	17.8	10.5
	Steady	44.1	39.4	43.7	38.5	53.5	52.4
	Decline	32.1	21.9	37.3	39.3	28.7	32.3
9. Confidence Level in Trend Viewpoint	Firm	26.4	29.4	22.5	28.9	26.4	24.2
	Estimate	43.8	40.6	49.3	39.3	44.2	46.0
	Guess	29.9	20.0	28.2	31.8	29.5	29.8

*actual count

These tables are included for completeness but should be interpreted with great caution. For a thorough report on engineers' salaries, the reader is

referred to *Engineers' Salaries: Special Industry Report* published by the Engineering Manpower Commission.

TABLE B1-B

MEDIAN SALARIES BY DEGREE LEVEL
For All Salaries Reported from 0-50 Years Since B.S.

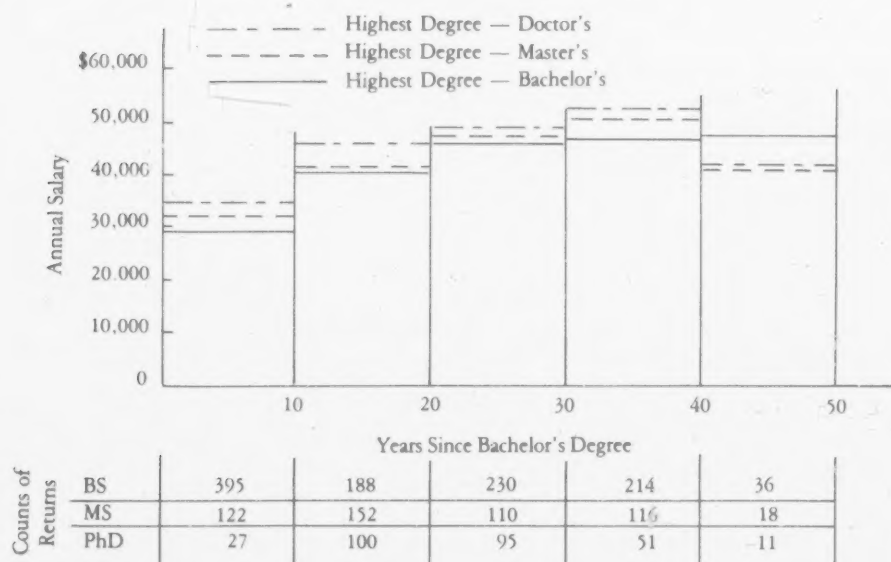
	1981 (1932)	1982 (1954)	1983* (1886)	% Increase* 1982-1983
Bachelor's	\$39,127	\$41,418	\$44,019	6.3
Master's	\$40,970	\$44,033	\$44,275	0.6
Engineer's	\$38,000	\$39,375	\$43,775	11.2
Doctor's	\$44,922	\$48,293	\$50,892	5.4

() actual count

*estimated by respondents

TABLE B1-C

AVERAGE SALARIES IN 1982
BY DECADE SINCE BACHELOR'S DEGREE



NOTE: Sample size in the 40-50-Years-Since-B.S. groups is small

TABLE B2-A
DEMAND FOR ENGINEERS BY BRANCH OF ENGINEERING
ALL EMPLOYMENT GROUPS COMBINED

NUMERICAL DATA

	Number of Engineers Employed As Of 10/31/82					Number of Job Openings As Of 10/31/82				
	Total	B.S.	M.S.	Ph.D.	No Degree	Total	B.S.	M.S.	Ph.D.	No Degree
Chemical	12,637	8,651	2,194	1,388	404	168	110	17	35	6
Civil	22,185	15,204	3,061	531	3,389	437	363	35	21	18
Electrical	42,278	30,400	6,650	1,541	3,687	1,794	1,386	276	69	63
Industrial	4,714	3,301	837	120	456	166	133	22	4	7
Mechanical	36,672	27,293	5,254	1,421	2,704	1,147	936	112	37	62
All Other	22,204	13,353	4,536	1,611	2,704	1,539	957	265	76	241
TOTAL	140,690	98,202	22,532	6,612	13,344	5,251	3,885	272	242	397

PERCENTAGE DATA

	Number of Engineers Employed As Of 10/31/82					Number of Job Openings As Of 10/31/82				
	Total	B.S.	M.S.	Ph.D.	No Degree	Total	B.S.	M.S.	Ph.D.	No Degree
Chemical	100.00	68.46	17.36	10.98	3.20	1.33	1.27	0.77	2.52	1.49
Civil	100.00	68.53	13.80	2.39	15.28	1.97	2.39	1.14	3.95	0.53
Electrical	100.00	71.91	15.73	3.64	8.72	4.24	4.56	4.15	4.48	1.71
Industrial	100.00	70.03	17.76	2.55	9.67	3.52	4.03	2.63	3.33	1.54
Mechanical	100.00	74.42	14.33	3.87	7.37	3.13	3.43	2.13	2.60	2.29
All Other	100.00	60.14	20.43	7.26	12.18	6.93	7.17	5.84	4.72	8.91
TOTAL	100.00	69.80	16.02	4.70	9.48	3.73	3.96	3.23	3.66	2.98

TABLE B2-A (Continued)
DEMAND FOR ENGINEERS BY BRANCH OF ENGINEERING
ALL EMPLOYMENT GROUPS COMBINED
NUMERICAL DATA

	Past 12 Mo. 10/31/81 — 10/31/82					Forecast 10/31/82 — 10/31/83				
	College	Hires Exper- ienced	Total	SEP's	NET	College	Hires Exper- ienced	Total	SEP's	NET
Chemical	499	316	815	414	401	208	287	495	209	286
Civil	732	599	1,331	988	343	551	437	988	614	374
Electrical	3,260	2,048	4,408	2,286	2,122	2,089	1,876	3,965	1,683	2,281
Industrial	280	250	530	294	236	148	118	266	161	105
Mechanical	1,742	1,362	3,086	1,935	1,151	1,268	1,177	2,445	1,263	1,182
All Other	1,782	1,708	3,490	2,130	1,360	1,701	2,565	4,266	1,853	2,413
TOTAL	7,377	6,283	13,660	8,047	5,613	5,965	6,460	12,426	5,783	6,641

PERCENTAGE DATA

	*Past 12 Mo. 10/31/81 — 10/31/82					**Forecast 10/31/82 — 10/31/83				
	College	Hires Exper- ienced	Total	SEP's	NET	College	Hires Exper- ienced	Total	SEP's	NET
Chemical	4.08	2.58	6.66	3.38	3.28	1.65	2.27	3.92	1.65	2.26
Civil	3.35	2.74	6.09	4.52	1.57	2.48	1.97	4.45	2.77	1.69
Electrical	5.88	5.10	10.98	5.69	5.28	4.94	4.44	9.38	3.98	5.40
Industrial	6.25	5.58	11.84	6.57	5.27	3.14	2.50	5.64	3.42	2.23
Mechanical	4.85	3.83	8.69	5.45	3.24	3.46	3.21	6.67	3.44	3.22
All Other	8.57	8.22	16.79	10.24	6.54	7.66	11.55	19.21	8.35	10.87
TOTAL	5.46	4.65	10.11	5.96	4.16	4.24	4.59	8.83	4.11	4.72

*Percentages are calculated as follows: subtract net change in past 12 months from number employed as of 10/31/82, divide number hired (or separated) in past 12 months by this difference. Multiply this figure by 100. For example, past-12-month-chemical-college-hires-percentage = $[499/(12637 - 401)] \times 100 = 4.08\%$.

**Percentages are calculated as follows: number forecast divided by number employed as of 10/31/82, multiply by 100. For example, forecast-chemical-college-hires-percentage = $(208/12637) \times 100 = 1.65\%$. () denotes negative value.

TABLE B2-B
DEMAND FOR ENGINEERS BY REGION
ALL EMPLOYMENT GROUPS AND DISCIPLINES COMBINED
NUMERICAL DATA

	Number of Engineers Employed As Of 10/31/82					Number of Job Openings As Of 10/31/82				
	Total	B.S.	M.S.	Ph.D.	No Degree	Total	B.S.	M.S.	Ph.D.	No Degree
U.S. Gen./multireg.	2,153	980	235	268	670	53	25	9	16	3
Pacific	10,796	6,892	2,078	647	1,179	564	503	25	17	19
South Atlantic	18,907	13,811	2,758	1,137	1,201	1,041	816	72	53	100
Mid-Atlantic	9,085	6,630	1,400	197	858	273	252	21	0	0
West N. Central	3,687	2,092	412	153	1,030	163	132	18	4	9
New England	2,858	2,040	229	119	470	79	69	6	3	1
East N. Central	11,635	8,906	1,874	240	615	604	484	83	15	22
Mountain	4,337	2,197	1,330	662	148	271	121	92	58	0
West S. Central	15,933	10,410	3,699	837	987	718	511	147	38	22
East S. Central	61,299	44,244	8,517	2,352	6,186	1,485	972	254	38	221

PERCENTAGE DATA

	Number of Engineers Employed As Of 10/31/82					Number Of Job Openings As Of 10/31/82				
	Total	B.S.	M.S.	Ph.D.	No Degree	Total	B.S.	M.S.	Ph.D.	No Degree
U.S. Gen./multireg.	100.00	45.52	10.92	12.45	31.12	2.46	2.55	3.83	5.97	0.45
Pacific	100.00	63.84	19.25	5.99	10.92	5.22	7.30	1.20	2.63	1.61
South Atlantic	100.00	73.05	14.59	6.01	6.35	5.51	5.91	2.61	4.66	8.33
Mid-Atlantic	100.00	72.98	15.41	2.17	9.44	3.00	3.80	1.50	0	0
West N. Central	100.00	56.74	11.17	4.15	27.94	4.42	6.31	4.37	2.61	0.87
New England	100.00	71.38	8.01	4.16	16.45	2.76	3.38	2.62	2.52	0.21
East N. Central	100.00	76.54	16.11	2.06	5.29	5.19	5.43	4.43	6.25	3.58
Mountain	100.00	50.66	30.67	15.26	3.41	6.25	5.51	6.92	8.76	0
West S. Central	100.00	65.34	23.22	5.25	6.19	4.51	4.91	3.97	4.54	2.23
East S. Central	100.00	72.18	13.89	3.84	10.09	2.42	2.20	2.98	1.62	3.57

TABLE B2-B (Continued)

DEMAND FOR ENGINEERS BY REGION

ALL EMPLOYMENT GROUPS AND DISCIPLINES COMBINED

NUMERICAL DATA

Past 12 Mo. 10/31/81 — 10/31/82

Forecast 10/31/82 — 10/31/83

	College	Hires Exper- ienced	Total	SEP's	NET	College	Hires Exper- ienced	Total	SEP's	NET
U.S. Gen./multireg.	152	247	399	433	-34	72	115	187	97	90
Pacific	523	474	997	506	491	480	793	1,273	272	1,001
South Atlantic	1,432	819	2,251	720	1,531	844	455	1,299	371	928
Mid-Atlantic	168	158	326	376	-50	132	134	266	261	5
West N. Central	124	97	221	202	19	116	169	286	77	207
New England	232	134	366	151	215	136	113	249	69	180
East N. Central	568	510	1,078	476	602	407	312	719	304	415
Mountain	115	197	312	290	22	173	112	285	153	132
West S. Central	828	799	1,627	1,618	9	836	941	1,777	1,452	325
East S. Central	3,235	2,848	6,083	3,275	2,808	2,769	3,316	6,085	2,727	3,358

PERCENTAGE DATA

*Past 12 Mo. 10/31/81 — 10/31/82

**Forecast 10/31/82 — 10/31/83

	College	Hires Exper- ienced	Total	SEP's	NET	College	Hires Exper- ienced	Total	SEP's	NET
U.S. Gen./multireg.	6.95	11.29	18.24	19.80	-1.55	3.34	5.34	8.69	4.51	4.18
Pacific	5.08	4.60	9.67	4.91	4.76	4.45	7.35	11.79	2.52	9.27
South Atlantic	8.24	4.71	12.95	4.14	8.81	4.46	2.41	6.87	1.96	4.91
Mid-Atlantic	1.84	1.73	3.57	4.12	-0.55	1.45	1.47	2.93	2.87	0.06
West N. Central	3.38	2.64	6.03	5.51	0.52	3.15	4.58	7.76	2.09	5.61
New England	8.78	5.07	13.85	5.71	8.13	4.76	3.95	8.71	2.41	6.30
East N. Central	5.15	4.62	9.77	4.31	5.46	3.50	2.68	6.18	2.61	3.57
Mountain	2.67	4.57	7.23	6.72	0.51	3.99	2.58	6.57	3.53	3.04
West S. Central	5.20	5.02	10.22	10.16	0.06	5.25	5.91	11.15	9.11	2.04
East S. Central	5.53	4.87	10.40	5.60	4.80	4.52	5.41	9.93	4.45	5.48

*Percentages are calculated as follows: subtract net change in past 12 months from number employed as of 10/31/82; divide number hired (or separated) in past 12 months by this difference. Multiply this figure by 100. For example, past 12-month-U.S. General-and-multiregional-college-hires-percentage = $[152/2153 - (-34)] \times 100 = 6.95\%$.

**Percentages are calculated as follows: divide number forecast by number employed as of 10/31/82; multiply by 100. For example, forecast-U.S. General-and-multiregional-college-hires-percentages = $(72/2153) \times 100 = 3.34\%$.

APPENDIX C
PARTICIPATING TECHNICAL
SOCIETIES
PARTICIPATING EMPLOYERS
TABLES

C1-A Participating Technical Societies
C1-B Society Response Statistics
C2 Participating Employers

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TABLE C1-A
PARTICIPATING SOCIETIES

AACE	American Association of Cost Engineers	ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
AAEE	American Academy of Environmental Engineers		
AEE	Association of Energy Engineers	ASM	American Society of Metals
AIAA	American Institute of Aeronautics & Astronautics	ASME	American Society of Mechanical Engineers
AIChE	American Institute of Chemical Engineers	ASQC	American Society for Quality Control
AIIE	American Institute of Industrial Engineers	IEEE	Institute of Electrical and Electronic Engineers
AIPE	American Institute of Plant Engineers	NICE	National Institute of Ceramic Engineers
ANS	American Nuclear Society	NSPE	National Society of Professional Engineers
ASAE	American Society of Agricultural Engineers	SES	Standards Engineering Society
ASCE	American Society of Civil Engineers	SFPE	Society of Fire Protection Engineers
ASEE	American Society for Engineering Education	SME	Society of Manufacturing Engineers
		SSS	System Safety Society
		SWE	Society of Women Engineers

TABLE C1-B
SOCIETY RETURN STATISTICS

SOCIETY	Number Mailed	Number Returns	Percent Returns	Total Membership	% Society Represented
IEEE	1,461	378	25.9	133,316	0.28
ASME	1,098	402	36.6	76,357	0.53
ASCE	1,026	365	35.6	67,215	0.54
SME	894	86	9.6	47,991	0.18
AIChE	830	44	5.3	43,001	0.10
ASM	685	135	19.7	39,000	0.35
NSPE	728	230	31.6	32,250	0.71
AIAA	626	160	25.6	24,459	0.65
ASQC	596	96	16.1	22,201	0.43
AIIE	581	129	22.2	21,130	0.61
ASHRAE	450	104	23.1	21,120	0.49
ANS	476	142	29.8	11,000	1.29
ASEE	381	50	13.1	9,088	0.55
ASAE	396	124	31.3	6,056	2.05
AIPE	324	69	21.3	5,120	1.35
AACE	283	34	12.0	3,579	0.95
SWE	51	39	76.5	2,967	1.31
AEE	190	31	16.3	2,700	1.15
SFPE	185	0	0.0	2,093	0.00
AAEE	173	41	23.7	1,925	2.13
NICE	170	220	129.4	1,810	12.16
SSS	115	27	23.5	1,000	2.70
SES	91	18	19.8	522	3.45
SPE	—	6	—	18,544	0.03
SAWE	—	4	—	1,164	0.34
Multiple Memberships		(342)			
TOTAL	11,810	2,592	21.9	576,608	0.45

TABLE C2
PARTICIPATING EMPLOYERS

Acco Babcock, Inc.	Central Hudson Gas & Electric Corp.
Alabama Power Co.	Central Nebraska Public Power & Irrigation District
Algonquin Gas Transmission Co.	CH2M Hill, Inc.
Al Johnson Construction Co.	Champion Products Inc.
Allendale Mutual Insurance Co.	Chemcut Corp.
Amax Base Metals R & D	The Chicago Faucet Co.
Amchem Products, Inc.	City of Cincinnati—Engineering
American Electric Power Service Corp.	City of Dayton—City Engineer
American Enka Co.	City of Dayton—Dept. of Water
American Sign & Indicator Corp.	City of Grand Rapids—City Engineering Office
American Standard, Inc.— Westinghouse Air Brake Division	City of Kansas City—City Engineer
Ames Rubber Corp.	City of Milwaukee—Bureau of Engineers
Amway Corp.	City of Norfolk—Dept. of Utilities
Ansul Co.	City of St. Paul—Public Works Dept.
Appalachian Power Co.	City of St. Paul Water Utility
Arkansas Legislative Council	City Public Service—San Antonio
Arkansas Power & Light Co.	Clifton Precision
ARO Corp.	Colorado Interstate Gas Co.
Arrow Lock Corp.	Commonwealth Edison Co.
Artisan Industries, Inc.	Computran Systems
ASARCO, Inc.	Conkey & Assoc., Inc.
Ash Grove Cement Co.	The Connecticut Water Co.
Auto Specialties Mfg. Co.	Consolidated Edison of N.Y., Inc.
Avco Electronics Div.	Consumers Power Co.
Bank Building Corp.	Cooper Energy Services
Bechtel Group	C.R. Velzy Assoc., Inc.
The Bendix Corp.	Cubic Corp.
Benedict, Bowman, Craig & Moos	Daily & Assoc., Inc.
Blue Ridge Electric	Deere & Co.
BMW Constructors	Dictaphone R & D
Bodine Electric Co.	Doboy Packaging Machinery
Borg-Warner Research Center	Dover Corp.
Brand Rex Co.	Dresser Engineering Co.
Brockway, Inc.	Dresser Industries
Brown-Minneapolis Tank	Drexel Univ.
Buffalo Forge Co.	Duo-Fast Corp.
Burgess & Niple, Ltd.	Duracell International, Inc.
Burns & McDonnell	East Bay Municipal Utility District
C.A.I.—Div. of Recon Optical	Eaton Corp.
Capitol Plastics of Ohio	E.C. Jordan Co.
Capitol Products	Edwards & Kelcey, Inc.
Carolina Telephone & Telegraph Co.	E.I. du Pont de Nemours & Co., Inc.
Catalytic, Inc.	Electric Power Board of Cattanooga

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- Electro Corp.
El Paso Products
Elwell Parker Electric
Emerson Electric Co.
EMR Photoelectric
Ensign Bickford Industries
E-Systems, Inc.
Exxon Res. & Engrg. Co.
Fairbrother & Gunther, Inc.
Federal Paper Board Co., Inc.
Ferro Corp. Tech. Center
Ferver Engineering Co.
Finkbeiner, Pettis & Strout Ltd.
Fleetguard, Inc.
FMC Corp.
Formation, Inc.
Franklin Electric Co.
Gast Mfg. Corp.
Gehl Co.
General Dynamics
General Electric Co.
GPU Service Corp.
Goodkind & Odea, Inc.
Greenwood Mills, Inc.
Grumman Aerospace Corp.
Gulf Research & Development Co.
Halcon SD Group, Inc.
Hall's Motor Transit Co.
Hardesty & Hanover
Harris Corp.
Harza Engineering Co.
Havens & Emerson, Inc.
Henry, Meisenheimer, Gende, Inc.
Hewlett-Packard
Holland Co.
The Hoover Co.
Howard, Needles, Tammen & Bergendoff
Hussey Mfg.
Hydrotherm, Inc.
ICSD Corp.
Idaho State Univ.
Illinois Bell Telephone Co.
Illinois Power Co.
Indiana & Michigan Electric Co.
Indianapolis Power & Light Co.
Institute of Gas Technology
International Engineering Co., Inc.
- Internorth
Intertherm, Inc.
Ionics, Inc.
Iowa Electric Light & Power Co.
Iowa-Illinois Gas & Elec. Co.
Ithaco, Inc.
ITT Corp.
Jacksonville Shipyards Inc.
Jacuzzi Bros., Inc.
Jeffboat Inc.
J.N. Pease Assoc.
Johnson Controls Inc.
Johnson Division—UOP, Inc.
Joy Manufacturing Co.
Kaman Aerospace Corp.
Kansas City Power & Light
Kansas Gas & Electric Co.
Kennedy/Jenks Engineers
Kershaw Mfg. Co.
Kirsch Co.
Kollmorgen Corp.
Lakeside Bridge & Steel Co.
Lego Systems Inc.
LFE Corp.
Lilliston Corp.
Lincoln Telephone & Telegraph
Litton-Amecom
Litton Industrial Products, Inc.
Lockheed Electronics Co., Inc.
Lockheed Engrg. & Mgmt. Srvc.
Long Island Lighting Co.
Los Alamos Nat'l Lab.
Los Angeles County Flood Control Dist.
Los Angeles County Road Dept.
Louisville Gas & Electric Co.
Marion Power Shovel Co., Inc.
The Maytag Co.
McDonnell Douglas Corp.
McGraw-Edison Power Systems Div.
Measurex Corp.
Midrex Corp.
Milwaukee School of Engineering
Minnesota Power
Mississippi Power Co.
Modular Power System, Inc.
The Montana Power Co.
Morris Knowles, Inc.
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Nalco Chemical Co.	Roper Pump Co.
NASA Lewis Research Center	Ruth & Going, Inc.
NLO, Inc.	S&C Electric Co.
Nat'l Radio Astronomy Observatory	St. Joseph Light & Power Co.
Nat'l Rural Utilities Cooperative	Sandia National Laboratories
Finance Corp.	Sargent & Lundy
Naval Avionics Center	Savannah Elec. & Power Co.
Naval Undersea Warfare Engrg. Station	Schnabel Foundation Co.
Navy Public Works Center	Shaffer, Johnston, Lichtenwalter
Nebraska Public Power District	& Assoc., Inc.
New York State Electric & Gas Corp.	Sonat Inc.
North Jersey Dist. Water Supply Comm'n	Southeastern Illinois Electric
Northrop Corp.	Coop., Inc.
Northwest Electric Co.	Southern Company Services, Inc.
NRC, Inc.	Southern Natural Gas Co.
Nuclear Data	Spencer White & Prentis, Inc.
Ohaus Scale Corp.	Sperry
Olga Co.	Sperry Flight Systems
Ortho Diagnostic Systems Inc.	Sperry Vickers
Pacific Gas & Electric	Springfield Utility Board
Pacific Power & Light Co.	Stackpole Carbon Co.
Pako Corp.	Standard Oil Co. (Indiana)
Pan Am World Services, Inc.	Stanley Consultants, Inc.
The Parker Pen Co.	State of Alabama Hwy. Dept.
Peabody Process Systems, Inc.	State of Arkansas Hwy. &
Pearl Brewing Co.	Transportation Dept.
Pellerin Milnor Corp.	State of Georgia Dept. of
Pendleton Construction Corp.	Transportation
Penton/IPC	State of Indiana Dept. of Highways
Peterson Mfg. Co.	State of Louisiana Dept. of
Pfizer Inc.	Transportation & Development
Pittsburgh Pacific	State of Maine Dept. of
Plastoid Corp.	Transportation
Plough, Inc.	State of Maryland Hwy. Administration
Porex Technologies	State of Michigan Dept. of
PPG Industries, Inc.	Transportation
PRC Engrg. Consultants Int'l	State of Mississippi Hwy. Dept.
Public Utility District of	State of Missouri Hwy. &
Grant County	Transportation
Pure Carbon Co.	State of New Mexico Hwy. Dept.
Pyrotronics	State of New York Dept. of
RE/Spec. Inc.	Transportation
Rexnord Inc.	State of North Carolina Dept. of
Richardson Gordon & Assoc.	Transportation
Rilsan Industrial, Inc.	State of North Dakota Hwy. Dept.
Robert Bosch Corp.	State of Pennsylvania Dept. of
Rocket Research Co.	Transportation
Rockwell International	

State of Vermont Agency of
 Transportation
 Stewart-Warner Corp.
 Stokely-Van Camp, Inc.
 Super Sagless Springs Corp.
 Sverdrup Technology, Inc.
 Sweetheart Plastics
 Syracuse Research Corp.
 Systems Applications, Inc.
 Tampa Electric Co.
 Telcom, Inc.
 Teledyne Avionics
 Texas Electric Service Co.
 Texas Gas Transmission Corp.
 Thiokol Corp.
 Tillet & Assoc., Inc.
 The Timken Co.
 Tippetts-Abbott-McCarthy-Stratton
 TMCA-Standard Steel
 Turner Collie & Braden, Inc.
 Underground Construction Co., Inc.
 Underwriters Laboratories
 United Energy Resources, Inc.
 US Air Force—Luke AFB—Civilian
 Personnel
 United States Borax & Chemical Corp.
 US Dept. of Agriculture—Agricultural
 Research Service
 US Department of Energy
 US Forest Service—Alaska Region
 US Forest Service—Rocky Mountain
 Region
 US Forest Service—Southwestern
 Region

US Forest Service—Washington, DC
 Universal Instrument Corp.
 Univ. of Colorado—Boulder
 Univ. of Connecticut
 Univ. of Hawaii
 Univ. of Iowa
 Univ. of Louisville—Speed Scientific
 School
 Univ. of Mississippi
 Univ. of Nevada—Las Vegas
 Univ. of Notre Dame
 Univ. of Washington
 Utilities Engineering Bureau
 Valtek, Inc.
 Van Zelm, Heywood & Shadford, Inc.
 Vermeer Mfg. Co.
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 The Washington Water Power Co.
 Waterous Co.
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 Wismer & Becker, Contracting Engrs.
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 W.M. Lyles Co.
 Woods Hole Oceanographic Institution
 Woodward Governor Co.
 W.R. Grace & Co.
 WVP Corp.
 Wyman Gordon Co.

NOTE: Although in many instances subsidiaries, divisions, bureaus, departments and offices have been an employer's primary respondent, we have taken the liberty of listing only the parent company where possible as the representative organization participating.

APPENDIX D

COMPARISONS WITH 1980 AND 1981 SURVEYS

This study is a successor to the 1981 study and the 1980 pilot study of the demand for engineers. The current study is similar in size to the 1981 study but appreciably larger than the 1980 pilot study.

As shown in Table D1-A, however, appreciable differences in the sample makeup also exist between the 1981 study and this 1982 study so that the comparisons of results shown in Tables D1-B and D1-C should be interpreted with considerable caution.

In the individual engineer sample (Table D1-A-1), this survey received an inadequate response from chemical engineers, and thus a weaker response from chemical, drug, rubber and plastic, and petroleum industries. On the other hand, response from the National Institute of Ceramic Engineers was enthusiastic so that the ceramic industry was over-represented.

In the employer sample (Table D1-A-2) this survey contains far fewer engineers without at least Bachelor's degrees and contains more large employers in the Cen-

tral region and fewer large multi-regionals. Professional distribution, while similar, does include more mechanical engineers.

Table D1-B illustrates the increasing pessimism of individual engineers as time passes from 1980 through 1982. The pessimism increase from 1980 to 1981 was more than justified by actual employer results reported in following years.

Table D1-C compares employer forecasts. College hires (except for "all other") were within 1.5 points of percentage growth forecasts, but hiring of experienced engineers was far below forecast, except for industrial engineers, where separations also were above forecast. Overall, for experienced engineers, net hiring (hiring less separations) was -1.3% rather than the +1.7% forecast. For the most part, forecasts for 1983 lie between the actual 1982 rates and the rates forecast for 1982. In the 1981 study forecasts for 1982 were closer to 1980 forecasts for 1981 than to 1981 actual results.

TABLE D1-A-1

INDIVIDUAL ENGINEER SAMPLE COMPARISON

	1982 Demand Survey	1981 Demand Survey
1. Survey Statistics		
Mailing	11,810	11,610
Valid Returns	2,592	3,081
Returns, %	22	27
2. Education (adjusted for non-response), %		
B.S.	54	53
M.S. or Engr.	30	30
Ph.D.	14	14
Assoc. or no degree	2	4
3. Geography, %		
Eastern, Atlantic (1, 2, 5)	40	39
Central (3, 4, 6, 7)	36	36
Western, Other (8-13)	24	25
4. Employer Size, %		
Over 100 Engineers	41	39
5. Employer Type, %		
Government	10	10
Educational Inst.	7	10
Chemical, Rubber, Plastics, Petroleum	6	11
Ceramics, Glass, Cement	11	3
Research Organizations, Labs	2	2
Aerospace	8	5
6. Professional Affiliation, %		
Chemical	2	9
Civil	14	13
Electrical	15	13
Industrial	5	4
Mechanical	16	15
Other	86*	46
Total	138%*	100
*Multiple memberships identified in 1982 survey, not identified in 1981 survey. Percents relative to 2,592 sample, i.e., 3,566 affiliations were reported by 2,592 individuals, of which 2,934 were from AAES-member societies.		
7. Years since B.S., %		
0-10	29	28
11-20	23	25
21-30	23	25
31-40	21	18
41-50	4	4

TABLE D1-A-2
EMPLOYER SAMPLE COMPARISON

	1982 Demand Survey	1981 Demand Survey		
1. Survey Sample				
Number of Employers	333	273		
Number of Employees	140,690	100,439		
2. Education (Distribution, %)				
B.S.	70	57		
M.S. or Engr.	16	21		
Ph.D.	5	6		
Assoc. or no degree	9	16		
3. Geography (Distribution, %)				
	No. Employers	No. Employed	No. Employers	No. Employed
Eastern, Atlantic	35	21	34	13
Central	46	66	46	17
Western, Other	19	13	20	70
4. Size (Disbribution, %)				
Employers with over 100 Engineers	34		30	
% of Employed Engineers in Establishments with Over 100 Engineers	95		95	
5. Employer Type (% of Total Employers)				
Consultants	11		11	
Government	12		14	
Utilities	13		10	
Metal Products	8		4	
6. Professional Category (Distribution, %)				
Chemical	9.0		9.0	
Civil	15.8		15.8	
Electrical	30.0		27.7	
Industrial	3.3		2.1	
Mechanical	26.1		17.0	
Other	15.8		28.4	

TABLE D1-B

COMPARISON OF FUTURE EXPECTATIONS (Forecasts By Individuals)

DEMAND EXPECTATIONS (% of Individual Engineers)

	INCREASE EXPECTED			DECREASE EXPECTED		
	1982 Survey	1981 Survey	1980 Pilot	1982 Survey	1981 Survey	1980 Pilot
	(10/1/82 to 10/1/83)	(10/1/81 to 10/1/82)	(05/1/80 to 05/1/81)	(10/1/82 to 10/1/83)	(10/1/81 to 10/1/82)	(05/1/80 to 05/1/81)
in Profession	28	49	52	20	12	9
in Region	21	37	35	32	20	16
In Organization	24	35	37	23	16	14

Actual Net Growth in Engineering Work Force as Reported by Employers in Following Year:

	1982 Survey	1981 Survey
	(10/1/81 to 10/1/82)	(10/1/80 to 10/1/81)
Net Growth, %	4.2	8.6
Net Experienced Growth, %	(1.3)	2.7

Seeking Engineering Employment:

1982 Survey	1981 Survey	1980 Pilot
14%	15%	13%

TABLE D1-C

COMPARISON OF FUTURE EXPECTATIONS (Forecasts by Employers)

	1981 Survey					Current Study									
	Forecast % Employment Change 10/31/81 — 10/31/82					Reported % Employment Change 10/31/81 — 10/31/82					Forecast % Employment Change 10/31/82 — 10/31/83				
	Hires					Hires					Hires				
	College	Experi- enced	Total	SEPS	NET	College	Experi- enced	Total	SEPS	NET	College	Experi- enced	Total	SEPS	NET
Chemical	3.8	6.1	9.9	7.6	2.2	4.1	2.6	6.7	3.4	3.3	1.7	2.3	3.9	1.7	2.3
Civil	4.2	6.0	10.2	6.0	4.2	3.4	2.7	6.1	4.5	1.6	2.5	2.0	4.5	2.8	1.7
Electrical	6.4	7.6	14.0	7.1	7.0	5.9	5.1	11.0	5.7	5.3	4.9	4.4	9.4	4.0	5.4
Industrial	7.7	4.8	12.1	5.7	6.7	6.3	5.6	11.8	6.6	5.3	3.1	2.5	5.6	3.4	2.2
Mechanical	5.6	8.7	14.4	7.0	7.4	4.9	3.8	8.7	5.5	3.2	3.5	3.2	6.7	3.4	3.2
All Other	4.5	17.2	21.7	12.2	9.5	8.6	8.2	11.8	10.2	6.5	7.7	11.6	19.2	8.4	10.9
TOTAL	5.2	10.1	15.3	8.4	6.7	5.5	4.7	10.1	6.0	4.2	4.2	4.6	8.8	4.1	4.7

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